

WIRED

Conspiracy of Heretics:
Joel Garreau on GBM

Game ratings: "★★★★"

Prophet of Privacy:
Steven Levy on Whitfield Diffie

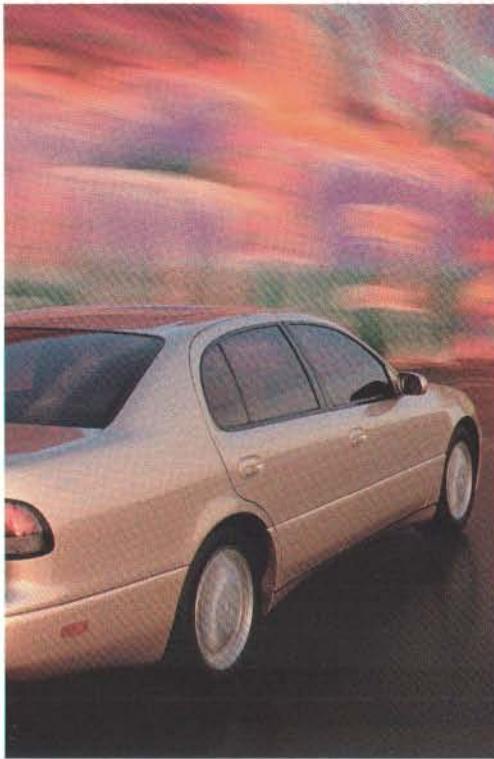
November 1994

Rocket Science

Videogames get HollyWired!
The first digital
supergroup.



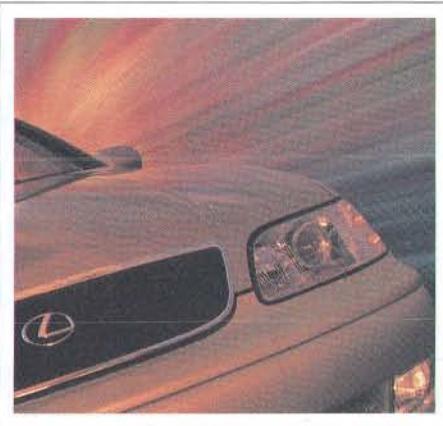
The rear double-wishbone suspension is finely tuned, providing the GS with sporty, road-hugging response.



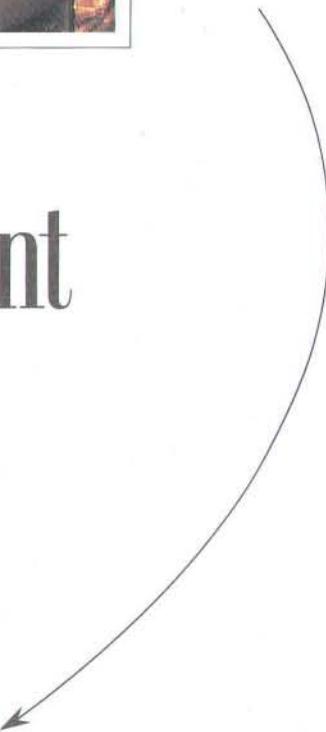
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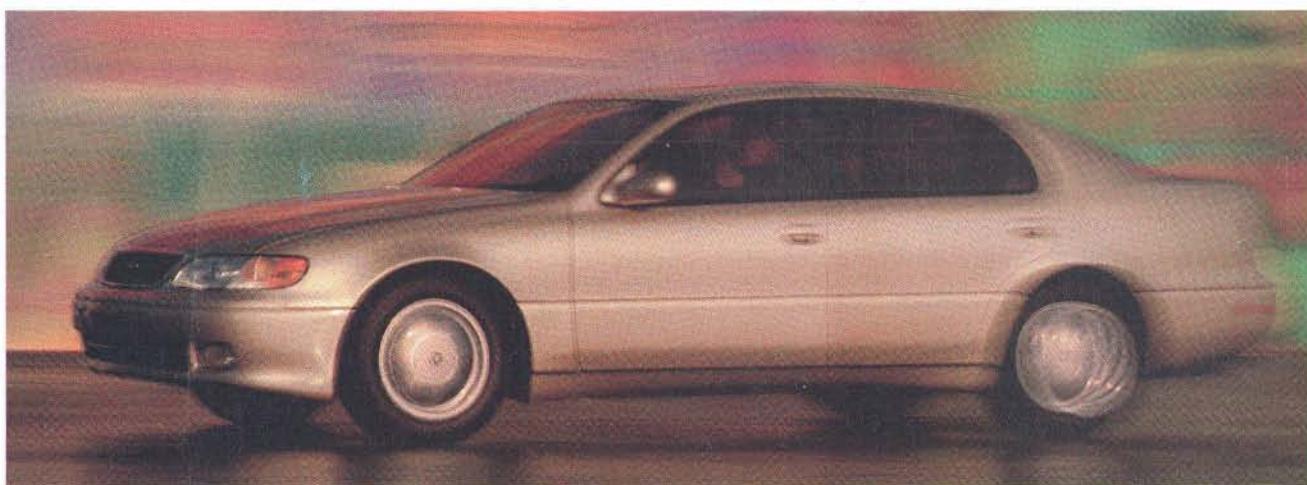
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EMPLOYEE EVALUATION

NAME: Chris Wolfe **DATE PREPARED:** 9-8-9

TITLE: Product Manager **DEPARTMENT:** Account Management

OVERALL PERFORMANCE:
 Outstanding Commendable Satisfactory Needs Improvement

COMMENTS:

Chris has become an indispensable member of the account team. He has demonstrated a high level of motivation and enthusiasm for the job. Perhaps the most compelling evidence of this can be found in his ability to work independently, where he picks up new tasks easily with little need for supervision or instruction. He consistently recognizes and works around obstacles to maintain productivity. Consequently, he often completes assignments ahead of schedule. At a time when collaboration is more critical than ever, Chris has also proven to be an excellent team player. He works effectively with coworkers on projects where teamwork is essential, and can easily motivate and inspire others to achieve. When delegating tasks, his thoughts are well organized and his ideas clearly articulated – an indication of his excellent communication skills. His projects are all distinguished by an attention to detail. His conclusions are always sound and logical. And he excels in time management, effectively compiling and analyzing information. He always manages to work efficiently, setting an example for effort throughout the company. Promotion and appropriate compensation are recommended at this time.

Chris Wolfe
Employee's Signature

J. Bloom
Evaluator's Signature

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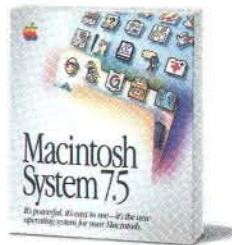
than 50 refinements, enhancements and improvements that will do more than simply change the way your Macintosh personal computer works—they'll change the way you work. Making you more productive than ever.

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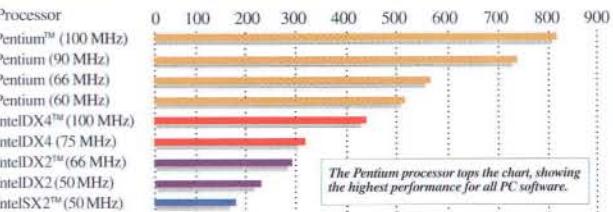
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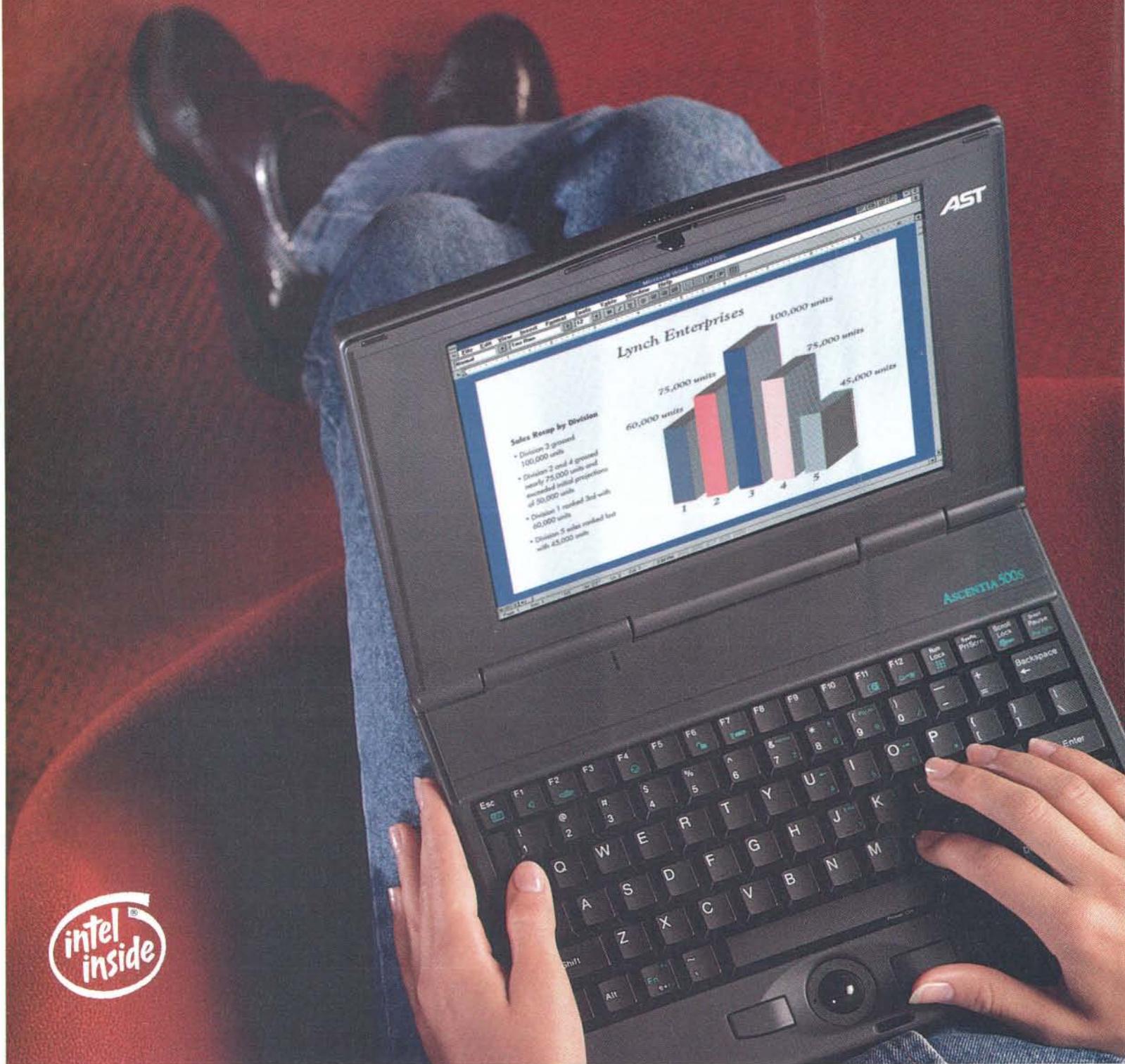
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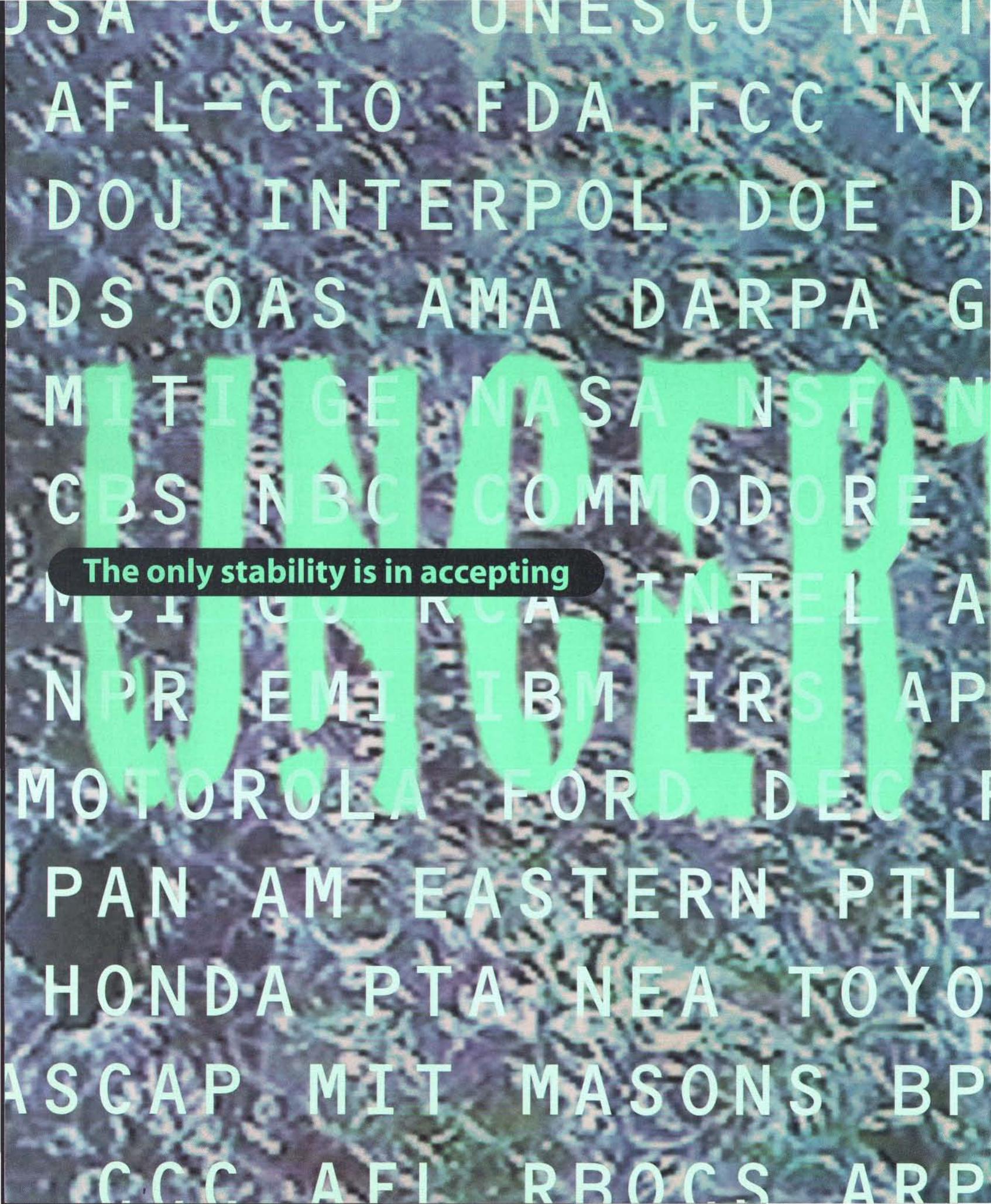
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As far as we're aware, subnotebook users don't have smaller fingers or better eyesight.



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The Global Business Network was founded in 1988 as a think tank to shape the future of the world. It's succeeding. By Joel Garreau

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Reel Virtual

Bob Greenberg's R/GA Digital Studios has created work you've probably seen in *Superman*, *Zelig*, and Diet Coke commercials. What's next? Interactive advertising. By David Bennahum

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Rocket Science

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Pipeline

How did James Gleick, famous science writer, come to be a franchiser of Internet service? Interview by John Battelle

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Patriot Games

Can Chrysler dazzle both the ecology fanatics and the gearheads with a LeMans race car based on once-supersecret technology made suddenly available – at bargain prices – by the collapse of the defense industry? By Jon Lowell

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"G" Games

Welcome to the Next Level of the videogame industry: if you don't grovel and adopt ratings, some senator will rip your head off. By Rogier van Bakel

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Pacific Light #28

Jay Dunitz paints with electricity, literally. By Constance Hale

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Prophet of Privacy

He took cryptography out of the hands of the spooks and made privacy possible in the digital age – by inventing the most revolutionary concept in encryption since the Renaissance. By Steven Levy

Cover: Rocket Science co-founders (left to right) Ron Cobb, Peter Barrett, Mike Backes, and Steve Blank photographed by William Mercer McLeod, August 1994, Berkeley, California.
Thai translation courtesy of International Contact Inc.

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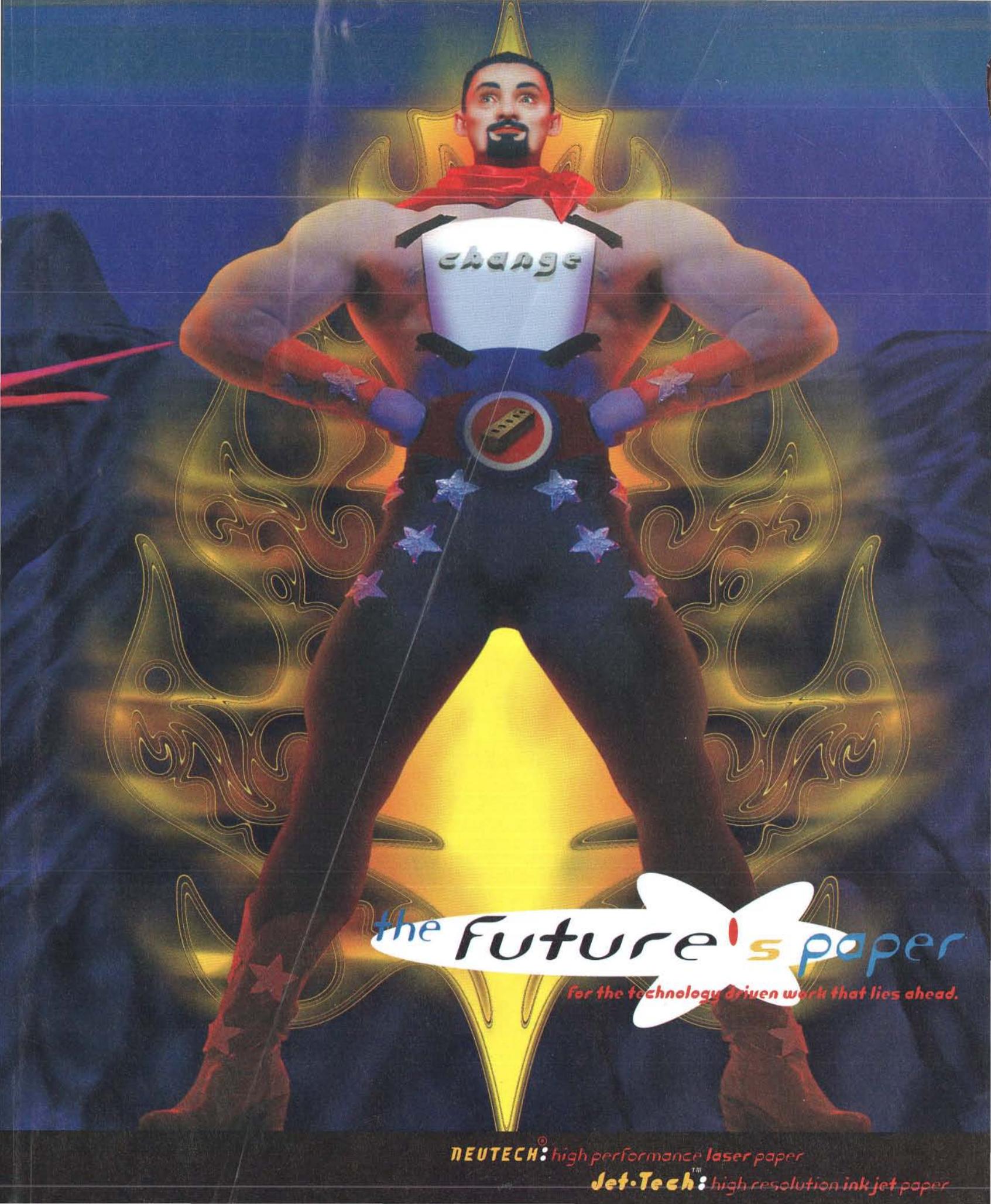
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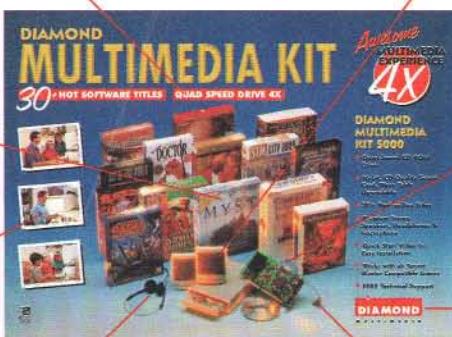
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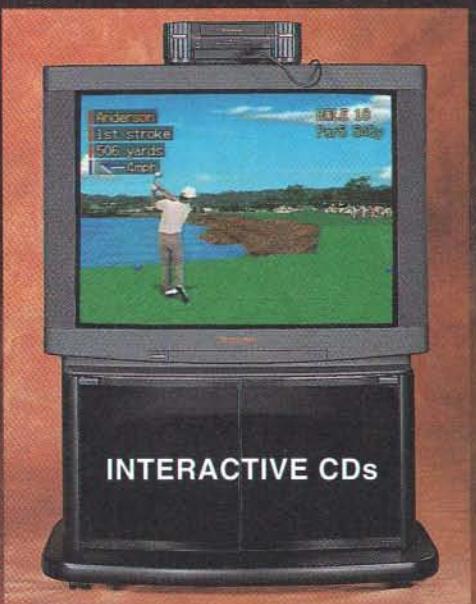
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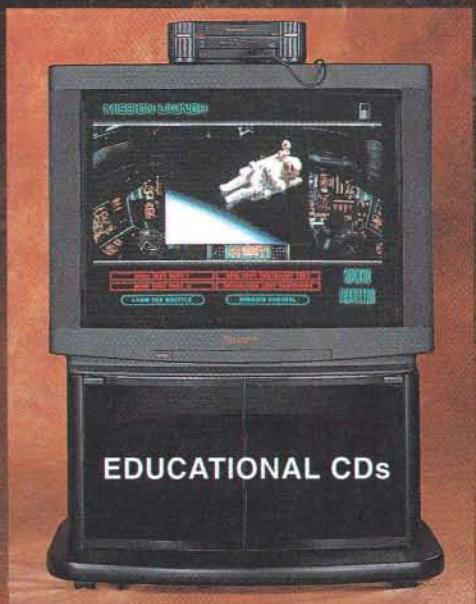
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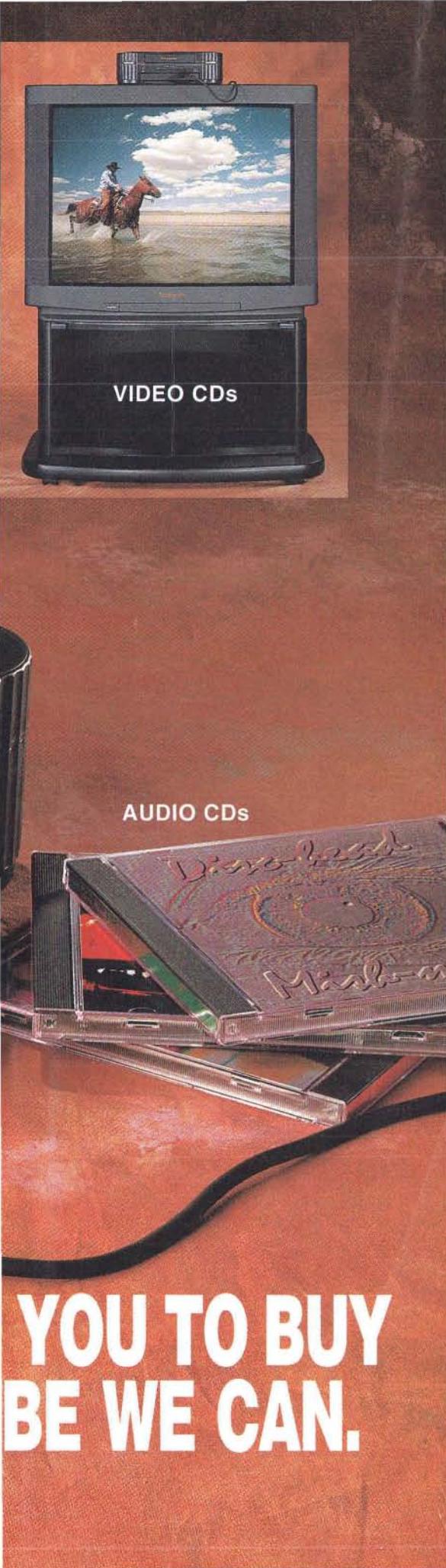
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Rants & Raves

Holy Cow?

I'd like to congratulate *Wired* on another journalistic first: the fictional corporate biography. As an employee of Paul Allen's Starwave, I was amused by Paulina Borsook's hard-hitting investigative profile, "The Accidental Zillionaire" (*Wired* 2.08, page 94), which clearly establishes her as the Geraldo Rivera of the information superhighway.

Borsook deserves a Pulitzer (Roxanne) for revealing the following true facts: 1. Allen's successful outside investments (AOL, Egghead, etc.) result merely from the "quantities of money he holds," and by influencing other investors, he "contaminates technology markets." (News flash: Investors tend to prefer making quantities of money.) 2. Starwave pays "hush money" to former employees, threatening that if they talk they will lose their remarkable severance packages. Only about 10,000 corporations in the US in their termination agreements ask employees not to make disparaging remarks. 3. Starwave isn't entirely clear "whether we're supposed to make money." That's news to those of us who moved thousands of miles with our families and left high-paying jobs because we believe in the future of a new media start-up. 4. Employees are being forced out. This is a serious charge to make without any detail about the level of the employee or any hint of a reason behind it.

Thanks for an entertaining story. I wonder what's next for *Wired* — "Warren Buffett: Accidental Investor," "Sam Walton: Accidental Entrepreneur," "Bill Gates: Accidental Partner of a Guy Who Developed Windows"?

Alex Alben
Starwave

I think you read my mind for your latest article in *Wired*. I recently left Asymetrix. Everything you put in the article about the company is right on target. I have had a hard time explaining to people why I left. Now I can refer them to your article.

The most efficient way to reach us here at *Wired* is via e-mail. At some addresses, such as *guidelines@wired.com*, you'll reach *Wired*'s Info-rama, which will bounce back the needed text, freeing up our human types to create the next amazing issue of *Wired*. Here's where to send e-mail:

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I congratulate you on writing the first article on Paul Allen that rings true. Other magazines are afraid to write anything negative about industry heavyweights, but *Wired* has the courage to support writers such as Paulina Borsook.

Harvard Business School would find a gold mine in Paul Allen for case studies on how not to run a business. Borsook never did mention the high turnover at Asymetrix; the average length of employment is on the order of seven to nine months. The annual rate of turnover there is in excess of 25 percent and has remained so for at least the last three years. And Starwave is already seeing a number of people bail out because of the bullshit; that company has become very much like Asymetrix. Also, you

would not believe how many suppliers the Allen estate has screwed over, monetarily and legally.

By the way, Virtual Vision is in Chapter 11 right now....

Name and e-mail address withheld on request

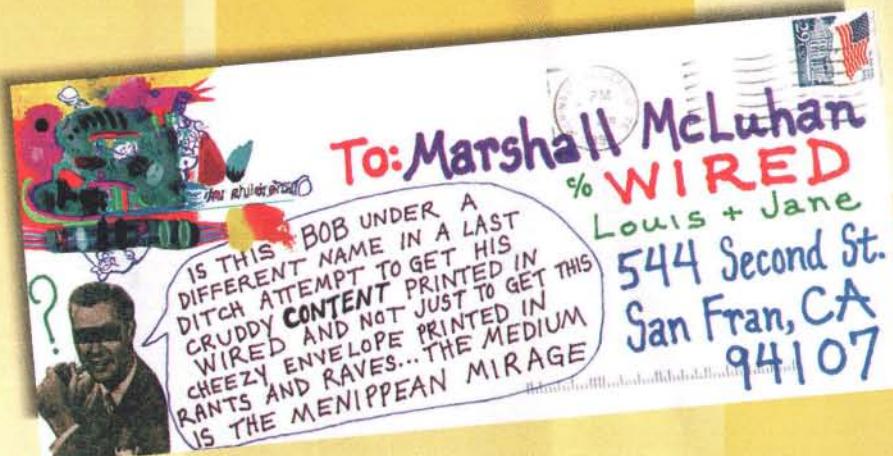
All the Asymetrix employees I've talked to think the article is great — the most truthful they've seen. Most concur that it's one of the first honest views of the Allen companies.

A flood of people are leaving Asymetrix right now because of the problems mentioned in the article. One local recruiter told an Asymetrix employee that he was the only one who wasn't circulating his résumé.

I'm glad I'm not working there anymore.

Name and e-mail address withheld on request

As a five-year veteran of Asymetrix's early days, I feel *Wired* owes Paul Allen an apology for the spiteful tone of its recent article about him.



Whether or not Paul's start-up companies turn a profit, whether or not Paul is as good a manager as Bill Gates, Paul above all deserves praise for choosing to reinvest his wealth in our society. Paul has created hundreds — and by now maybe thousands — of jobs with enormous potential for professional growth in cutting-edge technology.

Paul makes these investments not because of his "hippie trappings," but because he believes that capitalism is the best way to do good for everybody. Paul's investments express a deep and genuine goodwill toward his fellow human beings.

Whatever rules of engagement apply, Paul deserves respect and gratitude for choosing to stay engaged.

Adam Novick
Seattle, Washington

Three e-cheers and a virtual attaboy to Paul Allen! I have heard far too many judgments of technologies and technology investments rendered solely in terms of marketability and profitability. Remarkably, we have in

Allen a fabulously wealthy techie who hasn't lost his soul to market research, PR, and *The Wall Street Journal*. So what if Paul's investments are primarily motivated by the elegance of a hack or the coolness of an idea rather than how many software widgets he can sell? Fragile new technologies need patient cultivation to survive until they are ready for prime time. Allen's commitment to nurturing great ideas gives me strength to continue in this wacky business, just knowing that such romantics still exist in the shadow of such bad role models as Bill Gates and his ilk. And while we're on the subject, may I suggest a name for Microsoft's nascent online venture? E-ville.

Dave MacNeill
davemac@netcom.com

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Off with His Head

Thanks so much for torturing Edward Tufte ("Envisioning Interfaces," *Wired* 2.08, page 60) by presenting his interview through an amusingly busy layout that replaces the name of the "information design guru" throughout with a decapitated head icon. The designers of *Wired* do electronic publishing for a living, use imperfect equipment and programs, maintain a manic level of creativity, meet monthly deadlines, and – judging by *Wired's* healthy demographics – seem able to please staff members and audiences. You don't talk; you produce. Designer wannabes can learn much more from your magazine than from the staid professor and his vanity press.

Too bad, then, that the content of the article wasn't up to the irony of its visual style. More pronouncements like "A good design has a wholeness, an integrity, and a oneness that comes from a single intelligence.... I try to, that's what my work is.... A great design really has the quality of a revelation," we don't need.

Wendy Robinson
robin001@mc.duke.edu

Copy That

I just read "Art, No Waiting" and couldn't wait to respond (*Wired* 2.08, page 100). The sample work of art included with the article is positively Boschian but much more beautiful in its composition. I thought I was the only nut who dared to stick my head in various copy machines – waiting until no one was looking in public libraries before quickly pressing my face up against the glass, covering my head with a coat to shield the light from the outside. The results are hanging proudly on my wall. But I cannot conceive of walking into a professional photocopy business and asking, "Excuse me, but can I stick my head in your color copier, please?" So I'm glad that someone as decidedly gifted as Lieve Prins is taking this medium to its extremes of artistic possibility. But whoever owns those mammarys better get a mammogram – all that radiation! Just kiddin'!

Carol E. Mariconda
rcmaric@ritz.mordor.com

Every (Rasterbated) Picture Tells a Story

I was appalled and outraged by Benetton's "rasterbated" (the perfect word) depiction of an AIDS-ravaged Ronald Reagan ("How Reagan Got AIDS," *Wired* 2.09, page 31). To appropriate for one's selfish ends the image of an identifiable, living person in this manner is indefensible. I am not an apologist for Reagan, but I do have an interest in fairness, common sense, and decency. Apparently I am unlike Benetton management in this respect.

A simulation of this worldwide human tragedy's direct affliction of an actual person demeans everyone concerned, assaults the victim, and insults actual PWAs (Persons With AIDS), who do not have the

luxury of choosing "undo" on their image-manipulation software.

More unsettling, though not unexpected, is Benetton's misappropriation of the truth. The glib, self-assured, painfully simplistic implication that the Reagan administration was ossified in its response to AIDS and that *any* action "early in his presidency" would have averted "a global catastrophe costing millions of lives" is almost too outrageous to need a response.

Keep this in mind: Benetton is a for-profit corporation and, as such, exists solely to earn money for its owners. As with any for-profit corporation, Benetton's management does nothing that is not intended to benefit the company's bottom line. One of the scratches on the other side of the digital generation's coin is that, while the legal and moral aspects of misappropriating the work or images of others is still being debated and defined, simulated reality and the means to disseminate it are in the hands of entities like Benetton's PR department, not just Cyan and Voyager.

H. L. Ritter, MD
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An Idea Whose Time Is Present

Universal service is hardly, as John Browning suggests from his eminent and unworldly economic loft, an idea whose time is past ("Universal Service," *Wired* 2.09, page 102). If anything, it's an idea whose currency has increased with the importance of telecommunications media in daily life.

Let me admit my bias up front: I helped to write California's "Universal Telephone Service Act," which became the model for a less rigorous, more compromised federal program – one easier for the economists to criticize because it is so wishy-washy. It may come as a surprise to Browning (whose research leaves something to be desired) that California's universal service provisions actually started with "open access" as the motivation. I heard all of Browning's arguments in the process; they are just as flawed today.

You see, open access to communications services means *nothing* if you can't afford the basic technology to gain access. Throughout the US, where deregulation reigns, huge subsidies flow from small businesses and residential customers to large corporations and government agencies, largely through the so-called "access charge" imposed on local service in an effort to subsidize reductions in the contributions made by long-distance service providers. As much as US\$4 billion a year was flowing from local to long-distance service customers in 1986; who knows what Olympian peaks this subsidy has attained today? Browning's proposals would only widen the chasm. Do we need more welfare for the wealthy?

To paraphrase the French social critic Anatole

France, open access is majestic in its purity, permitting rich and poor alike to subscribe (at their own cost) to 500 channels of cable television and obtain the latest in wireless digital technology.

In California, surveys and random investigations undertaken by the Public Utilities Commission have found that universal service does exactly what it's supposed to do: keep the poor online. Abuse is minimal (fewer than 5 percent of recipients do not actually qualify, which is a hell of a lot better than almost any other entitlement you can name), and, with the exception of perhaps transients and migrant workers, everyone has a phone. Everyone has access. All without Browning's overwrought economic theory.

Next time, spare us the neoconservative philosophy and deal with the reality of telecommunications' essential character as the essence and expansion of First Amendment rights.

Bob Jacobson
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Stolen Signals

I would like to commend Charles Platt for his well-researched article on satellite signal piracy ("Satellite Pirates," *Wired* 2.08, page 76). It was an insightful look at a problem that has blackened the reputation of the direct-to-home (DTH) television market for many years.

My one complaint is his omission of one of the largest satellite trade magazines, *TVRO Dealer*, from the list of useful sources for additional information. *TVRO Dealer* has been covering the satellite industry for nine years, offering news about not only DTH technologies (C-band, Ku-band, and DBS), but also others that impact DTH, giving readers a complete, well-rounded dose of information every month.

Jeff Adams
jadamsinca@aol.com

Regarding Charles Platt's article "Satellite Pirates": a few years ago I installed an inexpensive Radio Shack satellite system and dish for my parents in a rural area of Northern California. Unfortunately, the receiver came without a decoder.

My parents were perfectly willing to pay for subscription programming, but it proved to be almost impossible to find a legal decoder. I called dealer after dealer. One offered to sell me a decoder, but he didn't know how much it would cost. He could make a long distance call to the company to find out, but I would have to pay for the call.

After checking a number of newspapers and magazines, I determined that a legal decoder would probably cost around US\$700, about twice what seemed like a reasonable price. More surprising, it was apparent that it would be far easier and cheaper to buy a pirate decoder.

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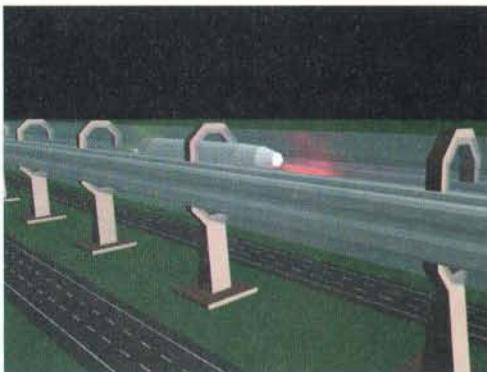
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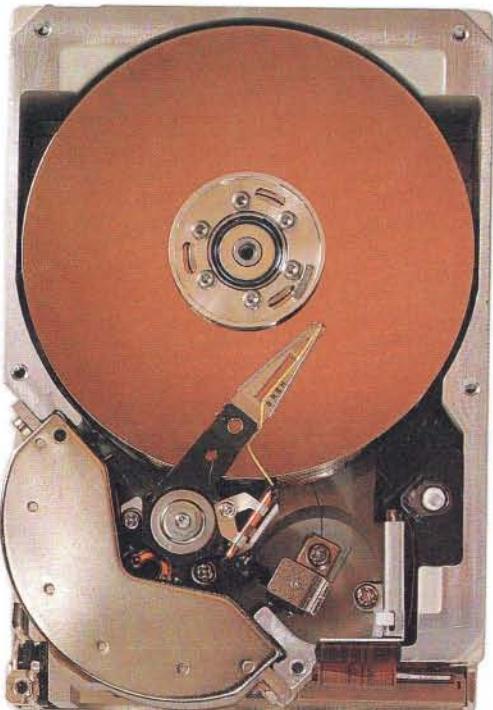
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In Europe, we have a similar problem with the English-language channels carried by the popular Astra satellite. Most of them have signed up with Rupert Murdoch's British Sky Broadcasting as part of a package called Sky Multi-Channels, which is available only in Britain and Ireland. Murdoch's decision to encode his popular Sky One channel last year deprived *Star Trek: The Next Generation* fans across Europe of their daily dose, and according to reports, it was this loss that prompted European hackers to crack Sky's coding system. The most recent hack is commonly known as the "Season 7" hack, in honor of *Next Generation's* final season.

Sky refuses to sell subscriptions outside of the British Isles because it has rights only for those areas. However, that must be viewed in the light of the European Union and the European Economic Area regulations requiring that goods and services be equally available to people in all 16 EU and EEA countries. Sky's rights agreements conflict with international regulations that legally should take precedence.

The old concepts of single-country rights agreements are nonsense in an age of cross-border satellite broadcasting. A terrestrial broadcaster reaches all households in its home country and pays for rights accordingly. But a satellite broadcaster reaches only those households that subscribe, and these can be in many countries. Rights agreements must be updated to reflect the new reality.

It's interesting that pirate cards and decoders are legal in Germany – that is, if they are for services not offered for subscription there.

George Wood
70247.3516@compuserve.com

Puttering in the Garden of Cyber Delights

Usually your Tired/Wired list is a cause for deep depression. Although I have been wired for 14 of my 24 years, cybersculture has always seemed to move in directions completely opposed to my own sensibilities.

So, imagine my surprise when your latest list mentioned Madonna as "tired," and my idol, Martha Stewart, as "wired" (*Wired* 2.08, page 34)! Finally, the flaxen-haired goddess of the garden, my lady of linen and silver, was being properly recognized as the pinnacle of style and aesthetics. Had electronic culture finally come to an understanding of the value of elegant dinner parties? Would her cookbook find a home on the Web? Would nerds the world over abandon their terminals to harvest sprigs of tarragon from their herb gardens? I excitedly told my housemate of this development, glowing with the knowledge that I was finally on the forefront of electronic fashion.

When he referred to her as an "ex VJ," I knew something was wrong – my Martha, shuffling tapes on some adolescent music-video show? I realized

with horror that my favorite role model had a trivial, pop-culture namesake, and that it was she, not my mistress of graceful living, that had been declared "wired."

My heart was blacker than the raven locks of your boob-tube Jezebel. For just a moment, I had a vision of a world where beauty and elegance would prevail over the screeching electronic religion of television, where a vine-ripened tomato would be a greater treasure than the latest cheesy video wipe. But I see now that my values are further than ever from the shifting whims of the digital frontier.

Anthony Berno
aberno@genome.stanford.edu

Fear not, dear reader. The Martha Stewart to whom we were referring was indeed that gentle mistress of divine domesticity and elegant entertaining. MTV indeed. Far be it from us to valorize cheap, popular entertainment.

Lord Vader, Unmasked

Although John Malone, aided and abetted by *Wired* interviewer David Kline ("Infobahn Warrior," *Wired* 2.07, page 86), did his best to dispel the Darth Vader image he has acquired, he dropped enough hints in the interview to prove that he clearly represents the Dark Side of the future of the infobahn.

First, he entices us with the prospect of less expensive telephony without ever actually promising it. And well that he does not: to assume that the current and projected cable networks could provide sophisticated telecommunications services (call waiting, call forwarding, three-way calling, Centrex-type central-office switching exchanges) in addition to their core businesses is to give cable companies far more credit than they have earned. Whether or not the recent government move to force the Regional Bell Operating Companies (RBOCs) to share their infrastructure successfully lowers telephone charges, the cable industry has much to prove to customers before cable will be trusted with a communications lifeline.

Second, Malone never addresses the fact that, even though he raised his voice to demand that the RBOCs give up their monopolies, he would never think of giving up the local monopolies enjoyed by cable companies nationwide. I can choose among a dozen phone-service providers all struggling to provide better service for less money, but, thanks to Malone and his ilk, I am stuck with one cable company imposing exorbitant rates and providing abysmal service.

Third, and most disconcerting, he hints at the future of cable. He notes that Basic Service will go by the wayside in lieu of a la carte cable services. I can look forward to the prospect of having to pay a separate fee for every single channel, making it possible for cable firms to raise rates on each chan-

nel individually, thus skirting all regulation currently on the books.

In sum, Mr. Malone seeks to hinder the phone companies with regulation and competition to prevent them from becoming players on the infobahn, while demanding that his industry remain free of both. His thinly veiled hypocrisy makes a powerful case for all of us to turn in our cable boxes for satellite dishes and examine carefully those who would provide our bandwidth.

David Wolf
chinahand@aol.com

A Moment of Silence

I've been a *Wired* reader since about 1.04, and I am amazed and truly disgusted that you have yet to say a word about the death of Gary Kildall. If you are unaware of who he is, you should find someone else to edit the magazine: Gary was the inventor of CP/M, the first widely available and standardized OS for microcomputers. Without him, *Wired* would have no reason to exist. Every part of MS-DOS owes its legacy to CP/M, and Big Bill Gates owes his every cent to the father of the stolen code that made up the first version of MS-DOS. Jump over to *comp.os.cpm* and read a little – you will soon realize that a computing pioneer as great as Alan Turing has passed from among us, and to him we owe much.

Think hard about integrity and pissing off Microsoft and print at least a short column about this industry pioneer. He is one man who refused to bow down before Big Blue (IBM), while Bill rolled around at IBM's feet and just begged them to use his pirated code.

Thanks for printing the truth, not the hype (leave that for *Time* and *PC Magazine*).

James Arlen
arlen@hubble.sheridanc.on.ca

Undo

► It seems we inadvertently compounded an error in August's "Undo." Ub Iwerks is in actuality the creator of *Minnie Mouse*; while he did work with Walt on the development process for "Plane Crazy," "Galloping Gauchos," and "Steamboat Willie," it was Walt who generated the initial character studies and who deserves the credit for Mickey's inception. Ub Iwerks should also be credited for his work on the Multi Plane Camera. ► In our review of *Netiquette* ("Mind Your Net.Manners," *Wired* 2.09, page 131), the correct contact phone number is +1 (415) 752 7666. ► We misspelled the name of R.U. Sirius's collaborator on "Pomo To Go" (*Wired* 2.06, page 54). It is Carmen Hermosillo. Our apologies.

Send your Rants & Raves to:

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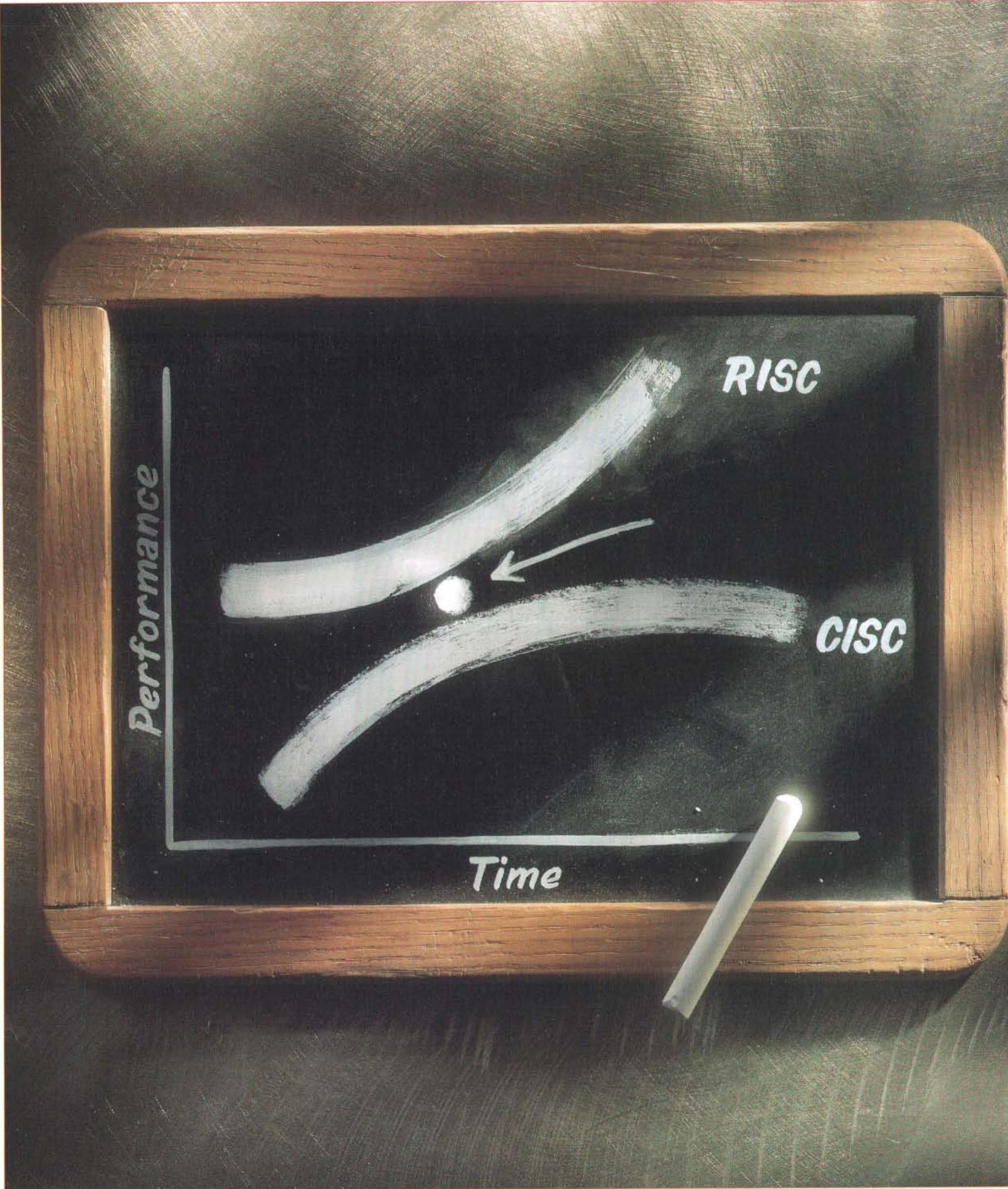


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Of course, all these advantages are hardly accidental. The fact is, because RISC (Reduced

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And the best is yet to come. Since RISC-based PowerPC chips are built with IBM superscalar technology, we can all look forward to even greater performance benefits down the road. Right this minute, in fact, systems from palmtops to high-end workstations are under development utilizing IBM's PowerPC 603™, PowerPC 604™ and PowerPC 620™.

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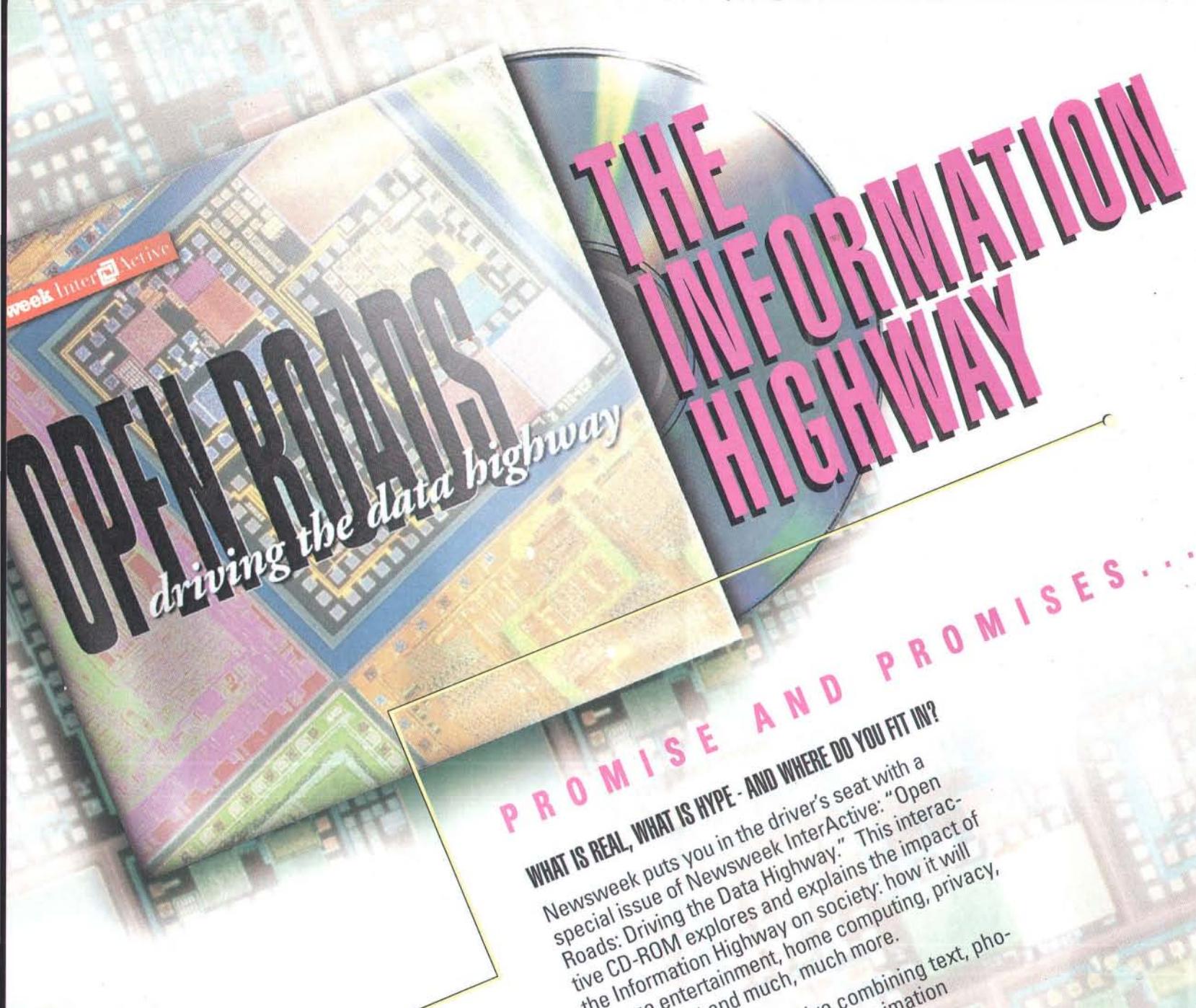
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Newsweek Inter@Active

Q: What Is the Information Superhighway?

A: It's just like the Internet, except:

- It's a lot more expensive.
- You can't post, and there's no killfile.
- There's no alt.sex or alt.drugs.
- The new rec.humor.funny has a laugh track.
- There's a commercial break every 10 minutes.
- Everything is formatted to 40 columns for TVs.
- The free software costs you US\$2 per Mbyte to ftp, more for long distance.
- There's a commercial break every 10 minutes.

I-Way

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Magic Carpet Ride

A: It's just like cable TV, except:

- It's a lot more expensive.
- The picture isn't as good.
- There are 500 channels of pay-per-view and home shopping.
- You can watch any episode of *Gilligan's Island* or any Al Gore speech for only \$2.
- There are no public-access channels.
- There's a commercial break every 10 minutes.



A: It's just like renting videos, except:

- It's a lot more expensive.
- There's only 1 percent of the selection.
- There's no porn.
- There's no pause, fast-forward, or rewind, and it costs you another \$3.95 if you want to watch something twice.
- There's a commercial break every 10 minutes.



A: It's just like the telephone, except:

- It's a lot more expensive.
- There's no one to talk to.
- Every number is a toll call.
- There's a commercial break every 10 minutes.



(posted anonymously to the Net)

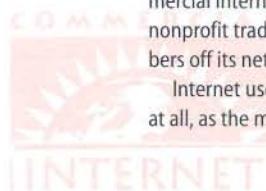
The Imagineers, those experts on fun at The Walt Disney Company, decided to make virtual reality work for the masses. Two years ago they made an offer to the animators who made *Aladdin*: you guys create a complete three-dimensional world for *Aladdin*, with the same hand-drawn quality as the movie, and we'll invent (no matter the cost) whatever hardware that's needed to transform your vision into a virtual world. And so they did. Using three Silicon Graphics Onyx computers stacked into one refrigerator-sized tower, a custom-fabricated headmounted video and audio helmet, a custom-designed kinetic saddle with steering stick, and a lot of proprietary software, Disney made a virtual reality world that really works.

The ride simulates a magic-carpet flight over and through the bazaars, oases, painted hallways, and underground tombs in *Aladdin's* world. A "guest" (Disney's term for a paying customer) sits in the rocking, carpeted saddle wearing the most comfortable headset yet made. An airplane-like control bar moves the carpet through a lush, seamless world. Guests can zoom down to the street or into rooms to interact with characters that respond

to the guests' movements and decisions. (Each guest rides alone in a separate world.) The goal is to find the scarab that leads to the lamp, using clues encountered along the way.

There are no lags, no jitters, no cartoonish polygons, no low-res blues – all the problems that have plagued mass-market virtual reality rides so far are gone. Instead, Disney's magic-carpet ride is as richly colorful and smooth as the film itself. It feels like being in the movie. This "realism" was achieved through brute computing power bought with brute money. Each seat – three Onyxes, electronic saddle, and headmount – costs US\$1.5 million. It appears there is a minimum amount of computational power needed for a seamless virtual world, and in 1994 a couple of PCs don't cut it. But Disney's custom towers, each with the power of approximately 2,000 Pentium PCs, do.

Disney has four seats up and running for the public in its Imagineering Labs at Disney World in Orlando. Disney will add seats and enlarge the virtual world incrementally. And the price of computing power will continue to drop until every theme park has a setup. – Kevin Kelly



It was a fun summer for commercial Internet service providers. First they got to worry about how many people *really* used the Internet (30 million? 3 million? Half a dozen?). Then they got to ponder what would happen when the Commercial Internet eXchange Association (CIX), a nonprofit trade group, began kicking nonmembers off its network.

Internet users think of the CIX, if they think of it at all, as the main alternative backbone for com-

All CIX members promise to interconnect with all other members without charging fees based on the amount of traffic. The CIX runs a technical facility, called a "router," where these connections can occur. This makes the CIX a strong force for universal, unmetered networking.

However, "unmetered" does not mean "free." Although the association recently lowered its annual dues from US\$10,000 to \$7,500, this is still too much money for many of the tiny home-

networks that they should all carry each other's traffic. It remains possible for most networks, large and small, to exchange data without passing through the CIX router. However, with the CIX beginning its crackdown, some CIX members may take steps to rearrange their networking processes to make it harder for nonmembers to get through. And this could be the first step toward the Balkanization of the Internet or toward a completely different system of networking based on metered tolls.

"In the old world it was assumed that we would all carry each other's traffic," says Randy Bush, an Internet old-timer and CIX member who runs the RAINet network in Portland, Oregon. "In the new world these tacit assumptions don't hold anymore."

Individual users tend to picture the Internet as a single, global network. But the Internet is really a collection of independent networks, and the new CIX policy may ultimately increase the number of times in our Internet sessions we see the words "connection refused." — Gary Wolf

FACING PAGE: BILL ZEMANEK

The End of the Internet?

mercial Internet traffic. Formed at a time when the main high-speed lines of the Internet were reserved for academic and scientific networking, the purpose of the CIX was to guarantee commercial connectivity between its members. In late 1992 there were seven CIX members; in January of 1994 there were 25; there are now more than 75. Members include such networking heavyweights as SprintLink, ANS CO+RE, NEARnet, BARRnet, PSI net, and others.

grown networks born during the past few years. Until recently, the association has relied upon voluntary payment of CIX dues. But on July 14, this year, the association decided that any network that had not paid the CIX would have its traffic stopped at the CIX router. The outcry from the smaller networks was immediate and intense.

Ironically, this decision will have little short-term impact on the Net, since the existence of the CIX has helped support a loose consensus among

III About Time: They finally got around to recognizing software as patentable, not that it clears up the deeper mess much (see "Patently Absurd," *Wired* 2.07, page 104). After two appeals, printer manufacturer Tektronix of Beaverton, Oregon, was awarded a patent on a software rasterizing process by the Court of Appeals for the Federal Circuit. The majority opinion found that while Tektronix's work was based on mathematical algorithms (a common justification for denying patents), it constituted "a specific machine to produce a useful, concrete, and tangible result." Why do we care? Software is now legally defined as a machine. Think on that one for a minute. **III Tout Bon!** Remember Mr. All

Good (Toubon), the French cultural minister who, in the name of purity, championed a law banning 3,000 English words from French lips? Turns out he's been shot down by none other than his own government's Constitutional Council, which found that Toubon's edict was contrary to France's 1789 Declaration of the Rights of Man. Hoist by their own (dare we say it?) petard. **III Microsoft Plugs In:** Readers of this space know that Bill & Co. have plans for an online service in the near future, and that Windows 95 (formerly Chicago) will include built-in Internet capability if and when it ever ships. (And you can bet those hooks talk directly to the new service.) That's a pretty aggressive move into new markets for the once-staid Office Supply Company. Ever wonder what sparked it? Could it be that the Microsoft ftp site is the most popular site on the Net? The company claims that more than 2 million visitors ►



Reading Reptile



It just don't seem right. The English alphabet has only 26 letters, while Japanese relies on at least 2,000 characters. Recognizing handwritten English has got to be easier than recognizing handwritten Japanese, right?

Wrong.

Turns out that the really difficult problem in handwriting recognition is dealing with cursive writing — figuring out where one letter ends and the next begins. And whereas English handwriting is typically cursive, the Japanese invariably print their characters as discrete blocks. So recognition accuracy is much higher with Japanese.

This difference helps explain why Apple's first Newton (made by Sharp) flopped in the US, while Sharp's own Zaurus (You know, like in dino-zaurus. A poke at Apple's "Newt"?) has been a big hit in Japan. Since late 1993, when the "personal information tool" (Sharp's term for PDA) hit the Japanese market, the company has shipped over 300,000 units.

The PI-5000 is listed at ¥65,000 (US\$650). The Zaurus PI-4000FX, which hit stores in July, comes equipped with an add-on fax modem ¥91,000 (US\$910). At last — something to plug into those cute little Japanese ISDN phones. — Bob Johnstone



The Brothers Bumpy

ABC's *Bump in the Night* is the first stop-motion animated television series since *Gumby*. But perpetual adolescents are tuning in to check out the blink-and-you-miss-'em psychotic *Bumpy Vision* cartoons that appear within the kids show. These are co-created by Stephen Holman, who used to animate cartoon shorts for the now vacant *Pee Wee's Playhouse*. To supply the show with "little pieces that stand out from the rest," Holman says, "I pick out bits in the script where Mr. Bumpy (the series's warty star) goes off on tangents and surrealist monologues."

Bits indeed. Although most of *Bump in the Night's* animation is done with traditional stop-motion, producers chose to do some segments,

such as the hallucinatory *Bumpy Vision* shorts, digitally. Enter John Duggan, the spring-loaded mind behind the frenetic look of Sega's *Sonic Spinball*. Drawing from a digital library chock-full of grabbed frames depicting the 3-D Mr. Bumpy in various poses, Duggan cuts, pastes, edits, and animates the green meanie. Also squeezed in are backgrounds, fly-by sprites, and various other digitized distractions. Says Holman: "We wanted really bright popping colors that stand out against the show, which is dark and moody and set in the night in this boy's bedroom."

Bump in the Night plays Saturday mornings on ABC. — Joe Hutsko

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...Voyager's CD-ROMs have already set new artistic standards."

—The New York Times, July 1994

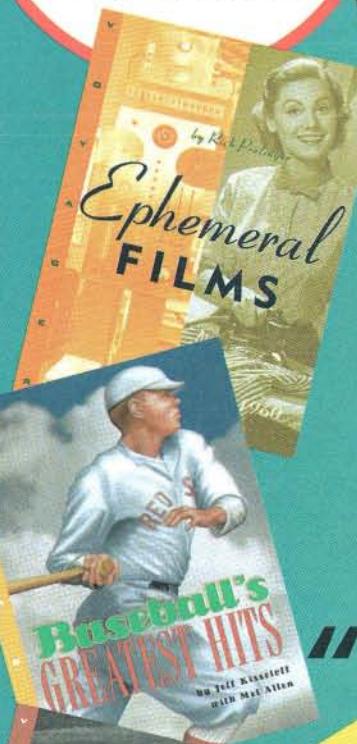
"Voyager wrote the CD-ROM on how to create top-notch multimedia titles."

—PC Magazine, September 1994

**BRING
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BRAIN**

**"My eyeballs
popped out!"**

Vizner István, Zurich, Switzerland (about *Freak Show*)



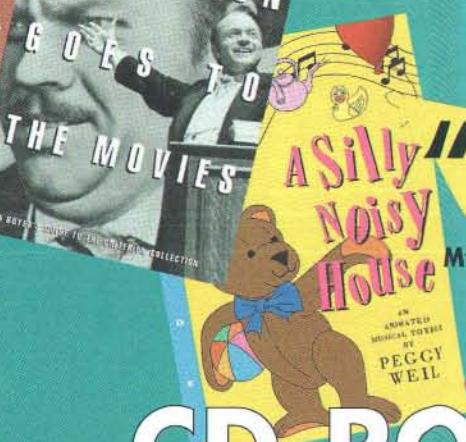
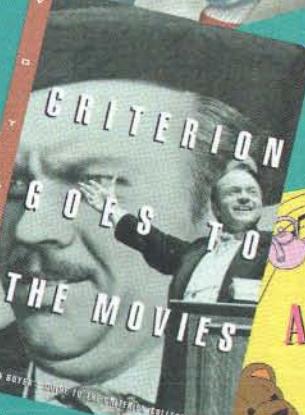
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A Smart Audience



"I feel

like my computer just took me on a trip
to Cooperstown."

—Dan Gutman, Author (about *Baseball's Greatest Hits*)



"Pure Fun!"

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My three-year-old just loves it."

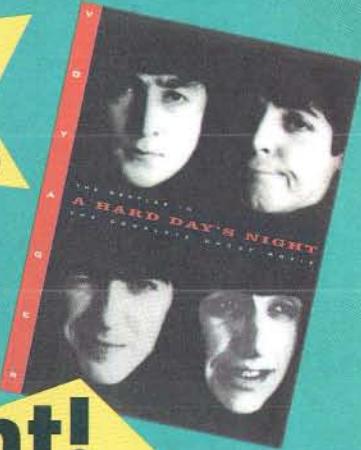
—David Halonen, Brighton, MI (about *A Silly Noisy House*)

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"Excellent!"

Never thought I'd see something like this
until after 2000 AD!"

—Andrew H. Snyder, Edison, N.J. (about *A Hard Day's Night*)



V O Y A G E R

As a founding member of the '70s minimalist ensemble Kraftwerk, Karl Bartos helped develop much of what is taken for granted in popular electronic music, including nonhuman singing talent.

Two decades later, Bartos and partner Lothar Manteuffel have formed Elektric Music to experiment with new ways to make the computer sing. For starters, they've sampled and digitized human speech to create a library of phonemes, the building blocks of speech. Bartos explains: "If you sample phonemes, you can paste them together in odd ways."

Even with recent advances in speech-synthesis technology, Bartos says getting computers to sing "is a time-eating process and has nothing to do with rock and roll. You sit in front of the computer engaging in trial and error. Perhaps it's easier to just boogie down."

Esperanto (Atlantic Records) marks Elektric Music's début. —Dan Sicko



Eine Kleine Elektric Music

► hit microsoft.com since it went up last year. **III Who Isn't Starting One?**: Microsoft has some competition, it seems. Sony Corp. is starting a WWW-based online service, initially to market its music offerings, but eventually to tie together all of Sony's operating companies, including Sony Electronics, Sony Music Entertainment, Sony Pictures Entertainment, Sony Electronic Publishing, and Sony Signatures. Let's hope it doesn't look like *Sony Style*. (We're not holding our breath.) And, as an aside, even the gray lady has a foothold in cyberspace: *The New York Times* is experimenting with an online national classified system. Lending technical chops is none other than The Pipeline (see *Wired*'s interview with James Gleick, page

114). **III Some Aren't Buying**: Microsoft, Sony, and all the others stampeding to make hay while the Net sun is shining would do well to go visit alt.destroy.the.internet, a Usenet newsgroup "whose primary purpose is the discussion, and hopefully the eventual development and usage, of various methods to destroy that accursed worldwide electronic network that goes by the collective name of 'The Internet.' The users of this newsgroup search for weaknesses in the Net's structure that they can exploit, with the hope that one day the entire Net will collapse and disappear forever!" **III Forza Italia**: They call it Associazione per la Libertà nella Comunicazione Elettronica Interattiva, but the easier way to think of it is the EFF, Italian style. Spurred by the EFF's success in influencing US policy, and a huge police assault against FidoNet BBSes (see "Hacker Crackdown, Italian Style," *Wired* 2.08, page

Making Cyberspace Safe for Democracy



It's fun for us onliners to think of ourselves as a boiling cauldron of anarchistic creativity, boldly telnetting where no loser has ever telnetted before. Great. So what happens when an online community has to agree on a budget, decide which workstation to buy, or determine whether advertising is allowed in cyberspace? Enter Marilyn Davis, creator of eVote, an online system for wired democracy.

The eVote software can be embedded in conferencing software,

news readers, and other groupware applications. Any user can propose a vote, which can be registered with yes, no, or a numerical rating; the results can be public or private. Davis calls it the perfect emulation of a town-hall meeting, in which participants propose, discuss, and decide. She likes to think of it as modeled after Quaker meetings, in which cycles of voting and discussion evolve until nobody disagrees, or the dissenters "stand out."

I tried the eVote demo by calling the eVote BBS at +1 (415) 493 8683 and logging in as eVote. The under-



TIRED

Drug smuggling
NASA
QuickTime
Smart drinks
CD-ROM
Twisted pair
Nanotechnology
Massive parallelism

Fractals
Netrek
Grunge culture
Real World
'Shrooms
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Techno
Viruses
Phone sex



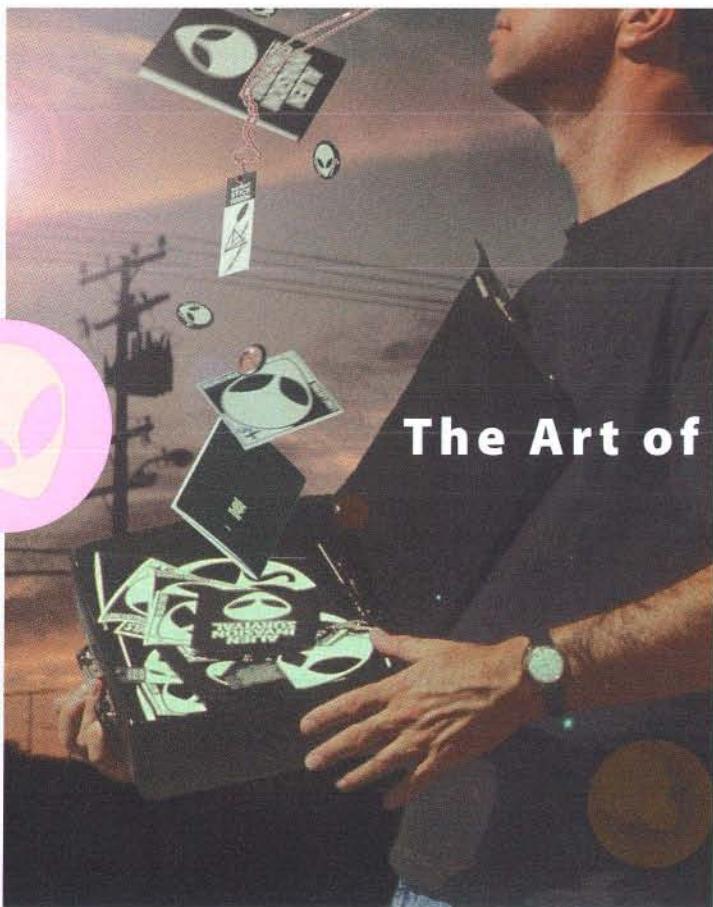
WIRED

Plutonium smuggling
Amateurs
CU-SeeMe
Smart materials
Holographic storage
Microcellular LAN
Biomimetic technology
Enterprise-wide computing
Wavelet transforms
Xpilot
Cocktail culture
My So Called Life
Organic DMT
Branding
Jungle
Plagues
ISDN video sex



lying database engine may be sexy, as Davis claims, but the demo interface sure is crude.

Any hope for a real-life implementation of eVote? Davis has not been shy in going straight to the top. She proposed to Jock Gill, special projects coordinator of media affairs for the White House, that the administration use eVote to set up a "Tell Bill" conference in which citizens submit, discuss, and vote on issues of the day. President Clinton would then personally respond to the top



The Art of

According to its instructions, Schwa is a line of products designed to defend against intergalactic invaders. There's a wordless book with stark black-and-white drawings of weird space creatures, an "Alien Invasion Survival Card," posters, stickers, gadgets, lunar calendars, and T-shirts, all of which are decorated with the same

art project in 1992, after reading an article called "The Secret Government" (he has no idea where the article came from). He now works on Schwa full time.

Does Barker believe in saucer people? "It seems unlikely," he says. "It would make the world a pretty corny place if it were true – if everything boiled down to us being

A b d u c t i o n

spooky, big-eyed alien head staring out at you.

"Schwa is whatever you say it is," explains Schwa creator Bill Barker, a good-natured guy from Reno, Nevada, with an almost too-straight appearance. "It explores disturbing things, from paranoia to control to conspiracy to absurdity to despair. It's also humorous."

Barker was inspired to begin the

controlled by these little beings. But I sure can't say it's not true."

To start amassing your own collection of cool Schwa goodies and save yourself from the imminent invasion, head over to <http://www.scs.unr.edu/homepage/rory/schwa/schwa.html> on the WWW, e-mail Barker at schwa@well.com, or write to PO Box 6064, Reno, NV, 89513. —Carla Sinclair

29), a group of Italians formed the ALCEI last July in Milan. For more info e-mail alcei@mailbox.iunet.it. **III Found on the Net:** An amusing list of the "Top 20 Engineers' Terminologies," with translations. First on the list: A NUMBER OF DIFFERENT APPROACHES ARE BEING TRIED; translated, this means "We are still pissing in the wind." EXTENSIVE REPORT IS BEING PREPARED ON A FRESH APPROACH TO THE PROBLEM really means "We just hired three kids fresh out of college," and TEST RESULTS WERE EXTREMELY GRATIFYING means "We are so surprised that the stupid thing ►

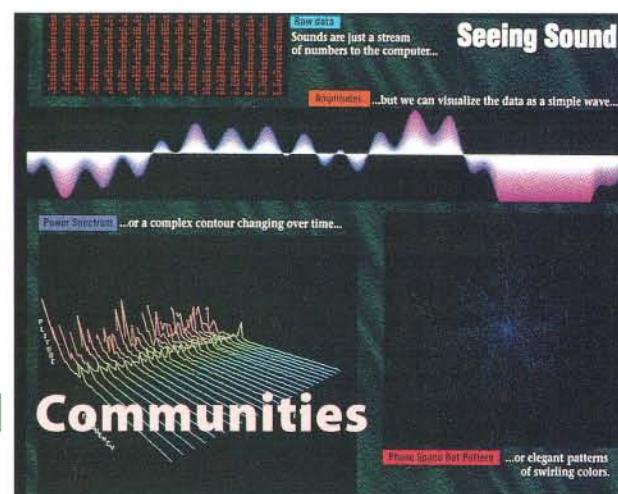
Oxygen: for Virtual Breathing Space

scoring issue each month. In a "Help Bill" conference, the prez would ask our advice in matters of state. Not any time soon, said Gill, who got himself into a testy e-mail to-and-fro with Davis over eVote's suitability for electronic democracy. Davis says Gill disparaged eVote, while Gill says in his e-mail responses that he never intended to comment on eVote per se, only on instant polling systems. Anyone for a show of hands? eVote: +1 (415) 493 3631, e-mail evote@netcom.com. —David Voss

If you were building new office space, you would call in an architect, some carpenters, and an interior designer. But what if you were constructing *virtual* office space?

You might get Oxygen, a groupware program developed by Art Technology Group. Founded in 1991, the Cambridge, Massachusetts-based company occupies offices resembling a cross between a software house and an artists' colony. Most staffers are former Massachusetts Institute of Technology students who studied at the Media Laboratory – including people skilled in software, graphics, music, video, and industrial design.

The Oxygen program – installed in July on the computer system of that techno-savvy ad agency, Chiat/Day – uses a small headshot to represent each member of a work group. Tapping into the program from anywhere in the world, group members copy their face-icons into a "project room" to begin their work day. Once there, they can check on the status of projects and swap text files (the exchange of audio and video files will be



possible in the near future). Or they can gather in the virtual café just to chat (words appear in cartoon-style balloons above each photo) and brainstorm – as if they were hanging around the coffee maker.

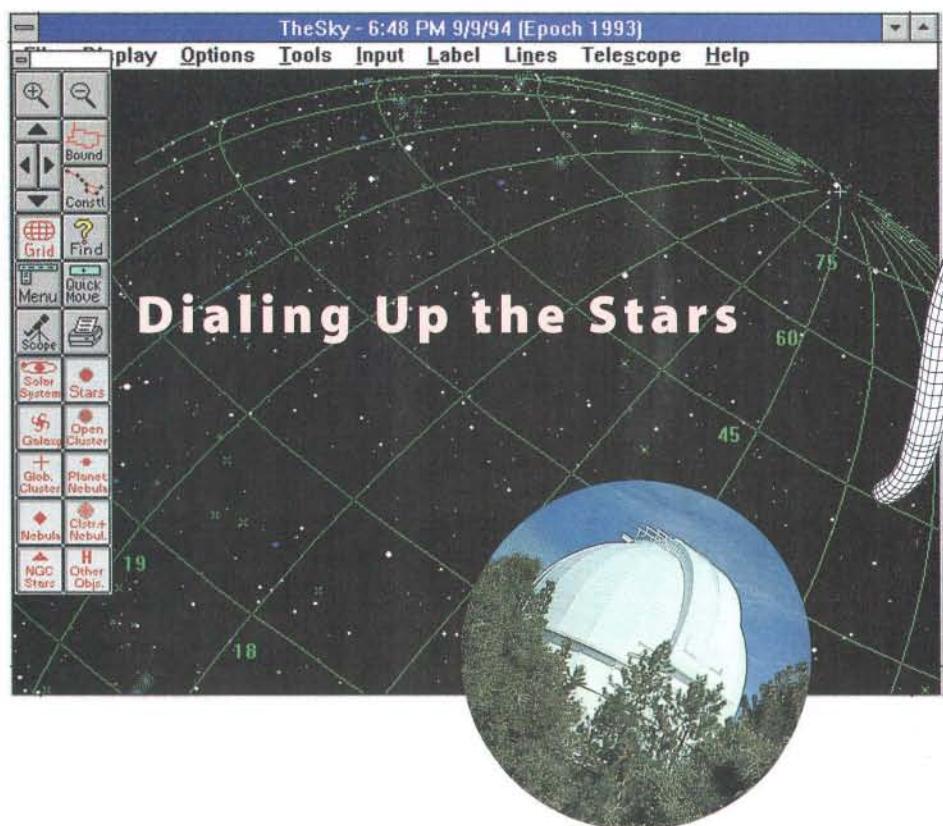
"Oxygenland" is laid out like a subway map – each branch represents a different department or account. "It's meant to form really flexible work groups on the fly," says Art Technology Group's co-founder and chief scientist, Joseph Chung, 29.

Art Technology Group's sales reached US\$1 million in 1993, and the company expects to more than double that figure this year. To keep up the growth, it must continually explore the outer limits of new media design. "Our core area is electronic communities," says company President Jeet Singh. "Such systems shouldn't be a substitute for everyday life. But they should be an integral part of it. Ultimately, we want to create a living and breathing conception of groupware." —Evan I. Schwartz

Mount Wilson, California, home of the 100-inch Hooker telescope, has been the site of more major astronomical discoveries than any other observatory in the world. It is here that Edwin Hubble theorized the "Big Bang." The Mount Wilson Institute is now giving elementary and high school students a way to reach out and touch the stars via modem, direct from their classrooms, through the Telescopes In Education (TIE) program.

Using off-the-shelf hardware and software, a 24-inch telescope at the Mount Wilson observatory allows students to locate and track thousands of astronomical objects. Students select an object using THE SKY remote astronomy software on their PC. The telescope then positions itself to point at the object and track it by compensating for the earth's rotation. A digital video camera attached to the telescope's eyepiece takes electronic snapshots of these objects and sends them to the classroom computer.

To access the telescope, schools need a Windows PC, a 9600 bps modem, and THE SKY software. All that remains is to schedule viewing time on the 24-inch telescope. Contact: Melanie Melton, Assistant Director, TIE, Box 24, Mt. Wilson, CA 91025, +1 (818) 395 7579, fax +1 (818) 395 7689. — Douglas E. Welch



Dialing Up the Stars

► works." **III Any Day Now:** Expect to see yet another wave of PDA expectation in the coming months, as the second tier of products hits the market. That market has been buoyed by predictions from analysts like Forrester Research, which sees PDA prices dropping to US\$300 and sales reaching 2.3 million units by 1998. **III Online Tutorial:** Imagine hitting a snag while doing a homework problem and having a network of more than 600 teachers and tutors standing ready to lend a hand. Sound like a latchkey kid's fantasy?

Nope. Send e-mail to homework24@aol.com and see what happens. **III Sour Apples:** Didja see what an Apple executive VP has to say in *Newsweek* on the subject of licensing Apple's Macintosh OS? "If we had licensed earlier, we would be the Microsoft of today." There's always tomorrow. **III Unclear on the Concept:** News item late this summer in New York City: "Police say Wiretap Log Is Lost." The story reports that an official log of police wiretaps was "stolen or misplaced," but — not to worry — "no investigations have been ►

J A R G O N W A T C H

JOOTT (Just One Of Those Things, pronounced "jute") — Inexplicable computer problems that appear and then fix themselves (or are fixed by turning off the machine or reinstalling the software). You have no idea what caused the problem or why it went away. It was a JOOTT.

Hollywooded — The community of companies using Silicon

Valley technology to create media products with Hollywood production values.

Chain Saw Consultants — Outside experts brought in to reduce the employee headcount (leaving the top brass with clean hands).

Domainism — Internet prejudice. Judging someone on the basis of how cool/uncool his or her e-mail address is. "Why should

anyone listen to you, you're posting from AOL!"

Starter Marriages — Short-lived first marriages that end in divorce with no kids, no property, and no regrets.

Render Farm — A networked collection of computers (usually more than six) set aside exclusively

for the purpose of rendering animations.

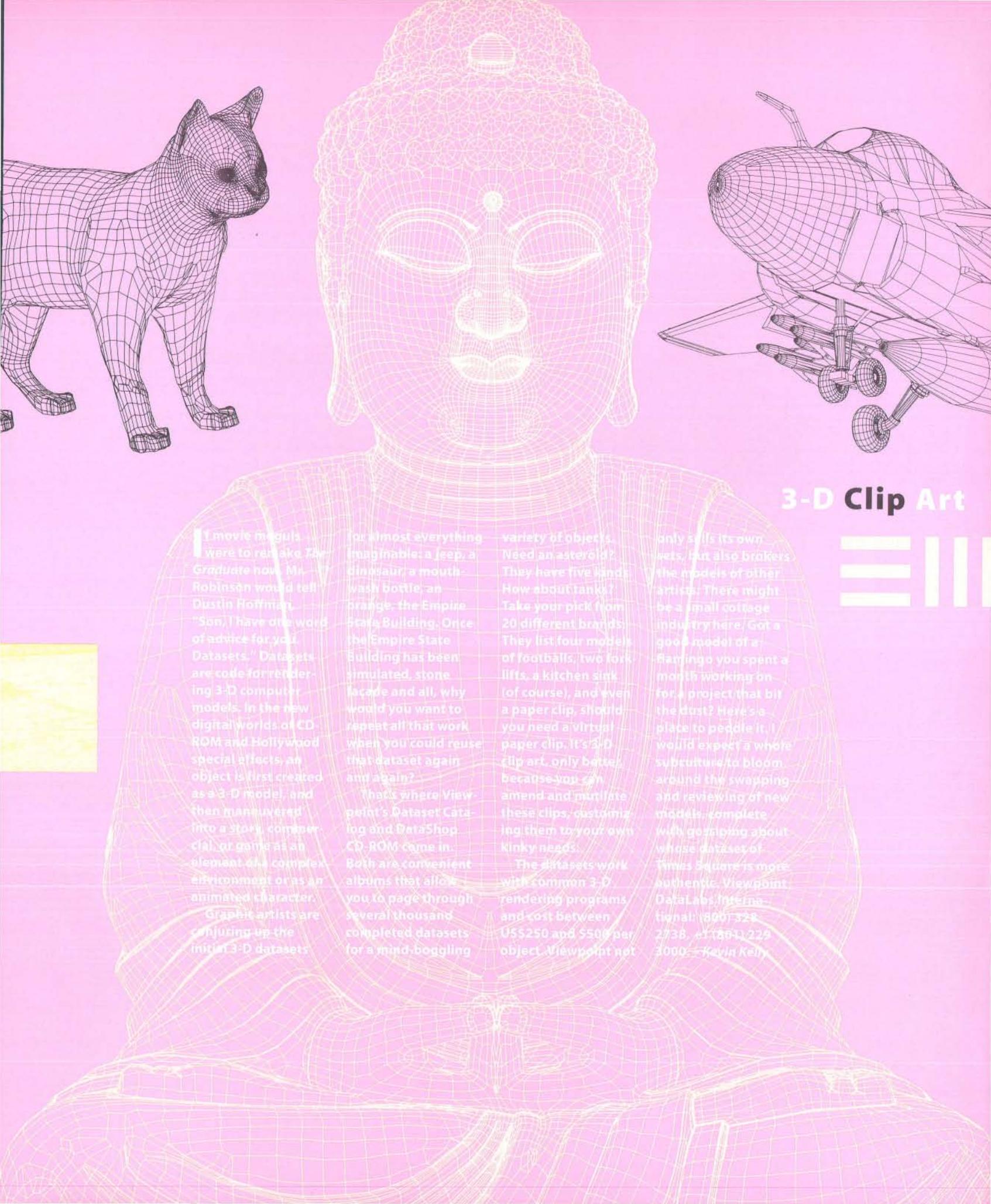
Wankware — Another term for X-rated software.

Uninstalled — Euphemism for being fired. Heard on the voicemail of a vice president at a downsizing computer firm: "You have reached the number of an uninstalled vice president. Please dial our main number and ask the operator for assistance."

Nutraceutical — Food with pharmaceutical properties (such as beta carotene).

Lobbyists are now petitioning the FDA to recognize this as a new category — a cross between a food and a drug.

Thanks, and a tip o' the prop-beanie to thanne, Kevin Kelly, Jamie and Jeanne, Karl Schmidtmann, and Etienne Tasse. — Gareth Branwyn



3-D Clip Art

If movie moguls were to remake *The Graduate* now, Mr. Robinson would tell Dustin Hoffman, "Son, I have one word of advice for you. Datasets." Datasets are code for rendering 3-D computer models. In the new digital worlds of CD-ROM and Hollywood special effects, an object is first created as a 3-D model, and then maneuvered into a story, computer game or game as an element of a complex environment or as an animated character.

Graphic artists are conjuring up the initial 3-D datasets

for almost everything imaginable: a jeep, a dinosaur, a mouth-wash bottle, an orange, the Empire State Building. Once the Empire State Building has been simulated, stone facade and all, why would you want to repeat all that work when you could reuse that dataset again and again?

That's where Viewpoint's Dataset Catalog and DataShop CD-ROM come in. Both are convenient albums that allow you to page through several thousand completed datasets for a mind-boggling

variety of objects. Need an asteroid? They have five kinds. How about tan X? Take your pick from 20 different brands. They list four models of footballs, two fork lifts, a kitchen sink (of course), and even a paper clip, should you need a virtual paper clip. It's 3-D clip art, only better, because you can amend and mutilate these clips, customizing them to your own kinky needs.

The datasets work with common 3-D rendering programs and cost between US\$250 and \$500 per object. Viewpoint net

only sells its own sets, but also brokers the models of other artists. There might be a small cottage industry here. Got a good model of a flamingo you spent a month working on for a project that bit the dust? Here's a place to peddle it. I would expect a whole subculture to bloom around the swapping and reviewing of new models, complete with gossiping about whose datasets of Times Square is more authentic. Viewpoint DataLabs International: (800) 328-2738, +1 (801) 229-3000. —Kevin Kelly



Just Say No to Techno



On July 27, a 20-year-old man was pulled over by Texas police, arrested, and kept in jail for five days on suspicion of possession of a controlled substance. He was released on US\$5,500 bail and awaits trial, pending chemical testing of the confiscated material.

It's a classic case of mistaken identity – of the material, not the man. The material in question was a copy of *Sheet One*, a CD made by musician Plastikman – aka Richie Hawtin – and released by Nova-Mute/Plus 8 Records. The CD's perforated artwork resembles a blotter of LSD hits.

According to Hawtin, the whole Plastikman album was "written as an analogy of a trip, either a journey or an acid trip. It is very repetitive and builds in intensity, reaches a high point and then comes down." The artwork was part of the concept and is chemically inert. Says Hawtin of the arrest, "I don't think anyone thought something like this could happen."

– Dan Sicko

► compromised." No investigations have been compromised? How about the accountability of the police department?

Hasn't that been just a tad bit compromised? NY Police Commissioner William J. Bratton said this: "It's not that big a thing. I'm not overly concerned about it." Art of the Deal: Creative Minds, a Knowledge Adventure spinoff, recently licensed the name and likeness of Donald Trump for use in CD-ROM games. Yup, the same Knowledge Adventure with those pesky accounting problems. (Like The Donald, they had a habit of overstating their expected revenues.)

When the BBC aired *The Net* last spring, about a million prime-time viewers each week tuned in to follow everything from the frivolous (say, new Nintendo games) to the frightful (neo-Nazi mobilization on BBSes). The second series of the TV

duced on the show or to download program scripts. John Wyver, the independent producer of *The Net*, is listening closely to the online discussions as he puts together the next series.

Although software bugs and reticence on the part

WIRED TOP 10 LISTSERV Mailing Lists

1. MINI-AIR	subscribers: 18,062
The Mini-Annals of Improbable Research	
Abstracts from the satirical "Annals of Irreproducible Results" and other articles. listserv@mitvma.mit.edu	
2. TOP-TEN	17,945
Late Show Top Ten Lists	
Late Top Ten lists from the David Letterman show. listserv@tamvm1.tamu.edu	
3. GOPHERN	17,777
Let's Go Gopherin'	
Distribution list for the "Let's Go Gopherin'" Internet tutorial. Now closed, available via gopher only at wings.buffalo.edu .	
4. CNDPSU-L	9,860
China News Digest (Global Service) IV	
For discussion of the <i>Chinese News Digest</i> . listserv@psuvm.bitnet	
5. CCMMAN-L	9,492
Chinese Magazine Network	
Discussions related to China and the Chinese Magazine Network (in Chinese). listserv@uga.bitnet	
6. TIDBITS	9,429
TidBITS	
Adam Engst's Macintosh-related newsletter. listserv@ricevm1.rice.edu	
7. NEW-LIST	8,840
New List Announcements.	
listserv@irlearn.bitnet	
8. CHINA-ND	8,755
China News Digest (US News)	
listserv@kentvm.bitnet	
9. PACS-L	8,283
Public-Access Computer Systems Forum	
listserv@uhupvm1.uh.edu	
10. RFERL-L	7,975
RFE/RL Research Institute Daily Report	
Digest covering developments in the former Soviet Union and Eastern European Countries. listserv@ubvm.bitnet	

Source: LISTSERV List Owners' Forum (lstown-l@searn.bitnet). These refer only to mailing lists running on rev.listserv, as of July 25, 1994. To subscribe to any of the lists, send e-mail to listserv@listserv.net with "subscribe" <listname> <your name> in the text (not the subject) of your message. — Gareth Branwyn



news magazine on cyberspace is scheduled for spring 1995 and will include analysis of how technology is changing work and culture.

Inspired by the series *About the Net*, the BBC Networking Club, sponsored by BBC Education, has put the BBC on the Net in the form of a Web page and a BBS called Auntie. Viewers weigh in with suggested improvements for future programming; they also log on to delve further into topics intro-

of some BBC officials has slowed progress of the BBC Networking Club's services. Julian Ellison, the club's head, is jockeying to make his organization the electronic forum for all BBC programming, including educational programs for British schools as well as news and educational programs delivered internationally through BBC World Service Radio.

To see for yourself set your WWW browser to <http://www.bbnc.org.uk>. — John Browning

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PERSONAL COMPUTER
1976

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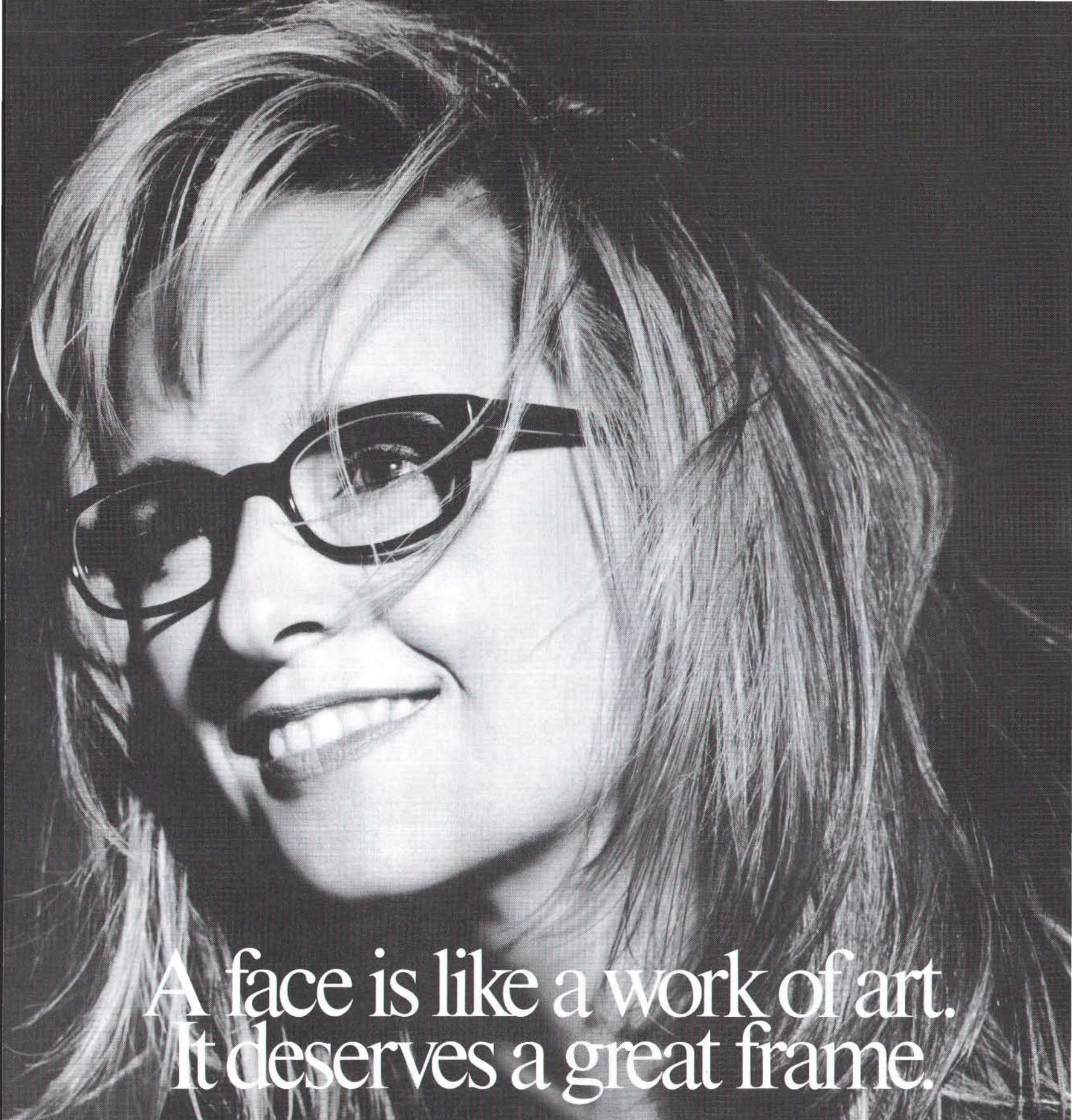
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Mouse Beautiful

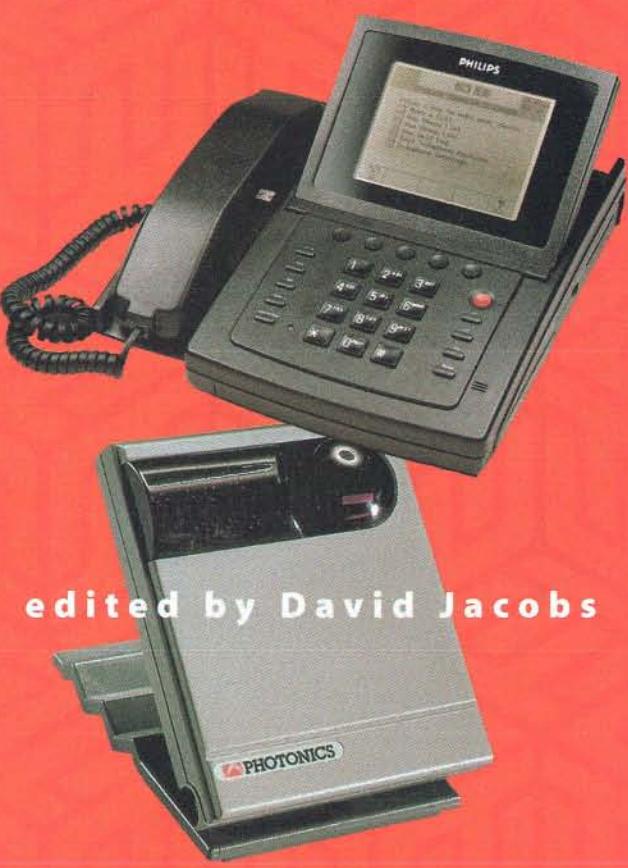
Most mousepads are either depressingly bland or sickeningly cute. Since my desk is already loaded down with more ugly junk than I care to report, I've adopted a Gallery MousePad. With a natural, latex-sponge base and an antistatic Lexan surface decorated with a famous work of art, the Gallery MousePad works great and looks great, too. The 16 different styles available range from Vincent Van Gogh to Keith Haring. Gallery MousePad: US\$18.95. Manticore Products Inc.: +1 (312) 862 2689, fax +1 (312) 862 2297, e-mail manticore8@aol.com.

F

Ricochet Network

The Photonics transceiver system, based on infrared technology, allows you to access your LAN without a wire. You use your familiar communications software, but your network connection is made via an infrared signal, not a hardwired line. The Photonics transceiver's signal spreads throughout the office, unlike the narrow infrared beam of your TV remote control, so you don't need to point your computer directly at the infrared eye. Cooperative Starter Kit: US\$749, additional access point base: \$109. Collaborative PC: \$449. Photonics Corp.: +1 (408) 955 7930 ext. 240, fax +1 (408) 955 7946.

H



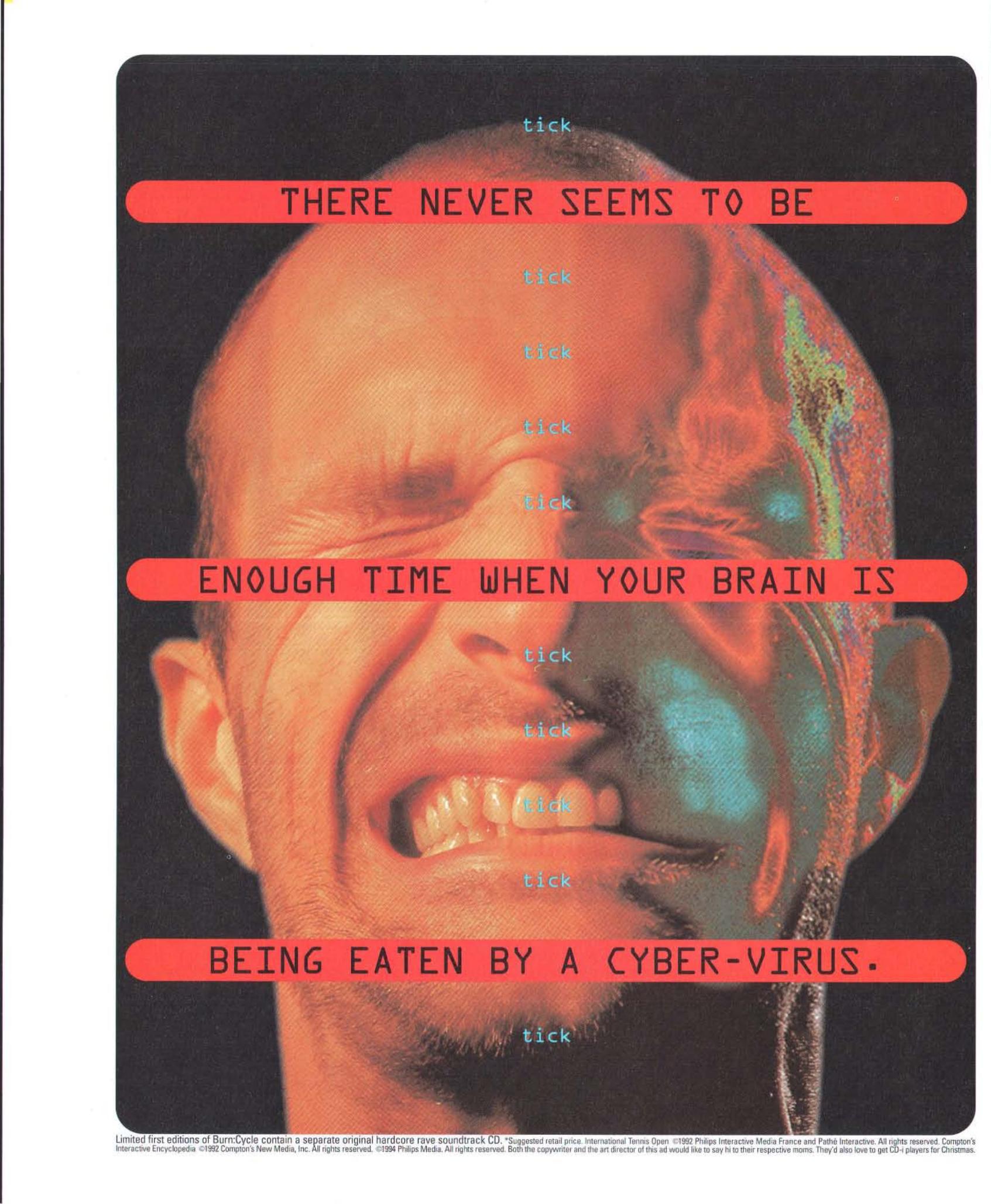
edited by David Jacobs

Office in a Box

Why do I have to buy a separate copier, fax machine, and printer when all these systems ultimately perform the same task of putting ink to paper? Hewlett-Packard must have also wondered why, because its new OfficeJet personal printer-fax-copier is not only an inkjet printer and plain paper fax, but also a copier that reproduces at full or reduced sizes. It outputs pages up to 300-by-600 dpi resolution, at a rate of three pages per minute. And it can receive and hold up to 24 faxed pages in memory. HP OfficeJet: US\$959. Hewlett-Packard: (800) 752 0900, +1 (208) 323 2551.

Buying Online

As soon as I plugged in the P100 screen phone from Philips I was hooked. The phone database and financial-and custom-calling services are hot. The screen phone has an 8086 processor, expandable to 4 Mbytes of RAM, a built-in modem and a grayscale display. Oh, and did I mention the keyboard, card reader, PCMCIA slot, and printer port? As impressive as all this hardware is for a phone, it's the software and the services that make the screen phone necessary for the truly wired. P100: US\$699. Philips Home Services: (800) 284 2428, +1 (617) 238 3400.



tick

THERE NEVER SEEMS TO BE

tick

tick

tick

tick

ENOUGH TIME WHEN YOUR BRAIN IS

tick

tick

tick

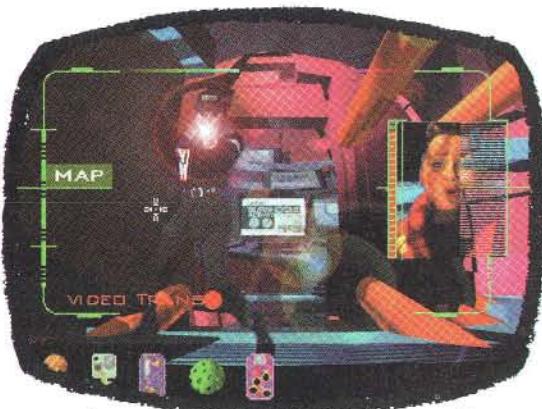
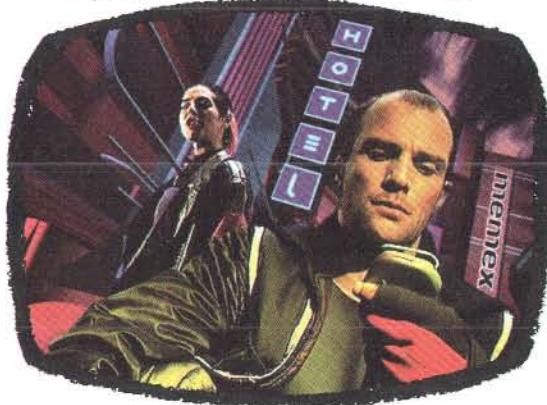
tick

BEING EATEN BY A CYBER-VIRUS.

tick



Prepare for total immersion. Burn:Cycle fuses a cyberpunk action-adventure movie with a frenetically paced role-playing game. Sound easy? Don't make us laugh.



Every nanosecond counts. Burn:Cycle is your wit and marksmanship meeting all the physical and mental challenges we throw your way. Be fast. He who hesitates is toast.



Hardwire your neurons. Critics are calling Burn:Cycle "a totally synthesized, fully transcendental, bio-controlled, electronic rush." Man, what an understatement.



Click forward to the year 2063 **tick** where you've become a jaded **tick** nihilistic data thief named Sol Cutter **tick** with a neural implant jack in your neck **tick** and one day while downloading corporate secrets **tick** into the software inside your skull **tick** you also contract a nasty little **tick** computer virus called Burn:Cycle **tick** which is basically gonna corrode your brain **tick** like battery acid in two hours unless you can **tick** outwit and outshoot relentless enemy agents **tick** find Doc the only guy who may know how to save you **tick** then make peace with your personal demons **tick** and somehow God help you **tick** locate the party responsible **tick** in this cold harsh neon-lit world **tick** before you bite the oh what a bummer **tick** your time's up



Magnavox 450 CD-i player now \$299.99* includes 2 free titles.

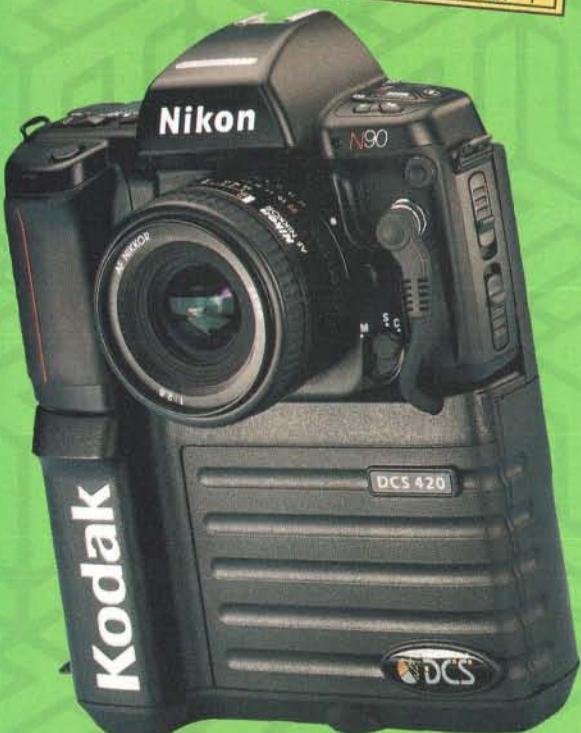
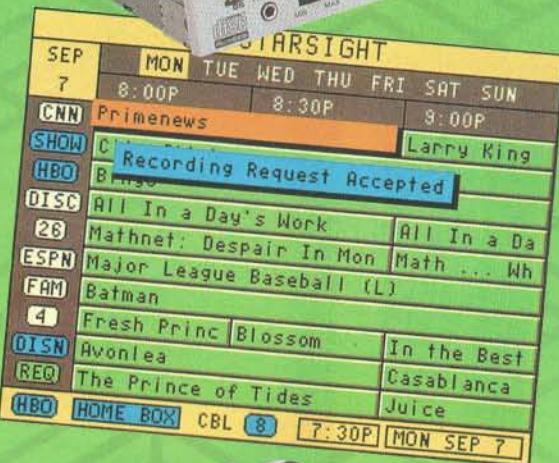
PHILIPS MEDIA

Couch Potato Hacking

Even people who can't figure out how to record Models Inc. on their VCRs will be able to figure out how to use the StarSight on-screen program guide. Connect this box to your TV and preview selected channels up to a week in advance, or channel surf in style with on-screen plot summaries. You can search for shows by title or subject, and once you've decided what to watch, use the one-touch recording feature to make sure you won't miss it. And if you want to wipe a channel off the face of the earth, just program the system to skip it from now on. Subscription: US\$5 per month. Stand-alone unit: approximately \$200. StarSight Telecast Inc.: (800) 643 7827, +1 (510) 657 9900.

World Builder

Forget those hokey PC systems with jerky motion and low-res graphics that only hint at the possibilities of virtual reality; this baby delivers on the promise. The PROVISION 100, based on an Intel workstation, is capable of rendering up to 300,000 polygons per second in stereo with full-color photo texturing. The VR software included provides an object-oriented programming interface. PROVISION 100 VPX: US\$49,600. Division Inc.: (800) 877 8759, +1 (415) 364 6067.



Fast Burn

A CD-ROM holds lots of data – the problem is that it's always somebody else's data. Make your mark on the shiny platters with the world's first quadruple-speed CD-ROM recorder, from Yamaha. The Expert Series CDR 100 half-height drive has an adapter for Macs, PCs, and other workstations, and is compatible with all standard CD recording formats. You can premaster CD-ROMs and audio CDs or back up your data quickly. CD Expert Series CDR 100: US\$5,000, CDE 100: US\$5,500. Yamaha System Technology Division: (800) 543 7457, +1 (408) 437 3133, fax +1 (408) 437 8791.

Skip the Darkroom

This digital camera from Kodak is perfect for taking high-quality color photographs when you don't have time to deal with darkrooms or Federal Express. The DCS 420 is based on a Nikon N90 camera body. It provides the feel and lens-switching capabilities of a traditional film camera but uses 36-bit color and digital storage to capture images. The PCMCIA slot supports a variety of hard-disk and flash-memory cards. The DCS 420 even has a built-in microphone to record notes about a shoot. DCS 420: US\$10,995. Eastman Kodak Co.: (800) 242 2424, +1 (716) 724 6888.

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Keys to a Better Back

Wrap your fingers around the curves of this keyboard to reduce the strain on your neck, back, and arms. The Microsoft Natural Keyboard boasts built-in, adjustable palm rests that straighten and support your wrists. This is made by the same people who brought us Windows, you ask? Well, yes, and the keyboard has two Windows-specific keys to provide fast access to active applications. Natural Keyboard: US\$99. Microsoft Corporation: (800) 426 9400, +1 (206) 882 8080, fax +1 (206) 936 7329.

Lots of Knots

Anybody who drives a vehicle beyond 125 mph is generally a cop, a crook, or rich enough to afford high-risk insurance. Either that or the driver is cruising behind the wheel of the 43 Scarab Superboat, the world's fastest offshore V-hulled vessel. Outfitted with three supercharged motors, the Scarab has a luxury cabin for serious power-lounging and an instrument panel that puts most aircraft to shame.

Why spend US\$600,000 on a Jaguar XJ220 and crawl on the highway when you can pick up a Scarab and go full throttle on the open sea? 43-foot Scarab Superboat: US\$500,000. Wellcraft Marine: (800) 755 1099, +1 (813) 753 7811, fax +1 (813) 751 7808.



► Adjust Your Attitude

I've never been able to jump out of bed refreshed and ready to seize the day. The jarring buzz of a typical alarm clock only makes it worse. But mornings became less miserable when I got Magnavox's AJ3930 clock radio, which wakes me with the CD of my choice. And there's no need to hunt across my cluttered night stand for the snooze button. I just wave my hand in front of the built-in motion detector to delay my day another nine minutes. AJ3930 CD Clock Radio: US\$179.95. Philips Information Center: +1 (615) 475 7317.

► Watch This Disc

S-VHS quality video and CD quality audio together on the same compact disc? Yep — it's called Video CD, and the SC-VC10 from Technics is the first minisystem in the world to support the new standard. Video CD is based on MPEG-1 compression technology, which can cram up to 74 minutes of digital audio and full-motion digital video on a single disc. Pretty impressive, though it means two discs are needed for most Hollywood movies. When you see this player in action, however, you won't mind taking a popcorn break to view the latest Video CD release. SC-VC10: US\$999.95. Technics: +1 (201) 348 9090.

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Canon

Stop the Digital Telephony Bill

Where in the US Constitution does it say that
the federal government has the right to tap your phone?

Three Things You Can Do Right Now to Stop Digital Telephony:

1. Call or write to:

• Representative Jack Brooks (his Judiciary Committee must approve HR 4922 before a vote in the House): +1 (202) 225 6565, fax +1 (202) 225 1584.

• Senator Patrick Leahy (the sponsor of the Senate bill): +1 (202) 224 4242, fax +1 (202) 224 3595, e-mail senator_leahy@leahy.senate.gov.

• Representative Don Edwards (the sponsor of the House bill): +1 (202) 225 3072, fax +1 (202) 225 9460.

2. Call or write your legislators and ask them to oppose the Digital Telephony bill. To find your own legislators, contact the League of Women Voters in your area.

3. Fax, mail, and e-mail your views to local TV stations, radio stations, and call-in shows. Write a letter to your local newspaper. Drop a note to vtw@vtw.org, where we'll track the coverage.

The bills' numbers are SB 2375 in the Senate and HR 4922 in the House. They can be referred to as the "FBI Wiretap Bills" in correspondence.

The FBI is pushing legislation (SB 2375 and HR 4922) in Washington, DC, that threatens to use what could become billions of dollars of your own tax money to spy on you. The following is based on the "Statement on the Digital Telephony Wiretap Bill" issued by the Electronic Privacy Information Center (EPIC), a project of the Fund for Constitutional Government and Computer Professionals for Social Responsibility. At press time, this legislation is still pending, but action is due shortly. You may still have time to stop it (see action points). Or you may be living in a much less free country than you were a month ago. — The Editors

The digital telephony legislation recently introduced in the US Congress is the culmination of a process that began more than two years ago, when the Federal Bureau of Investigation first sought legislation to ensure its ability to conduct electronic surveillance through mandated design changes in the nation's information infrastructure. Having examined the issue, EPIC remains unconvinced of the necessity or advisability of the pending bills.

We do not believe that the FBI has made a compelling case that new communications technologies hamper the ability of law enforcement agencies to execute court orders for electronic surveillance. The proposed legislation would establish a dangerous precedent for the future. The legislation would, for the first time, mandate that our means of communication be designed to facilitate government interception. The future of the National Information Infrastructure may be at stake.

What are the digital telephony bills and where did they come from?

The digital telephony bills were initially introduced by the Bush administration, presumably at the request of the FBI. The initial proposals were unpopular and met with great opposition, preventing them from moving through Congress.

The current incarnations of the legislation (SB 2375 and HR 4922) basically require common carriers to provide access to personal communications for law-enforcement officers with court orders. For instance, if the FBI presents a court order to Nynex for a wiretap on your phone calls, Nynex must provide the FBI with the ability to intercept your communications under the terms of the court order. To do this will require changes in the telephone equipment we use today. The bill appropriates US\$500 million in federal monies to these carriers to compensate them for the changes.

How will this affect me?

- Imagine there's a socket on the side of the phone company's equipment that says "FOR FBI USE ONLY" in giant red letters.
- Imagine that the fine for not implementing that socket is \$10,000 per day for the phone company. How many communications carriers do you think will make any noise about the privacy of their customers' communications?
- Imagine the FBI with its new powers. Do you trust it to respect your constitutional rights, given its record of consistently violating citizens' privacy since its inception?
- Imagine that other parties might like to listen in on your phone as well. How secure do you think this system will be against them?

- Then imagine that you've been asked to foot the bill.
- How much data has the FBI presented to the public to justify this suspension of Fourth Amendment privacy guarantees?**

Absolutely none. Despite repeated requests from a variety of responsible organizations, the FBI has provided no evidence that any ongoing investigation has been jeopardized by the inability to perform a wiretap.

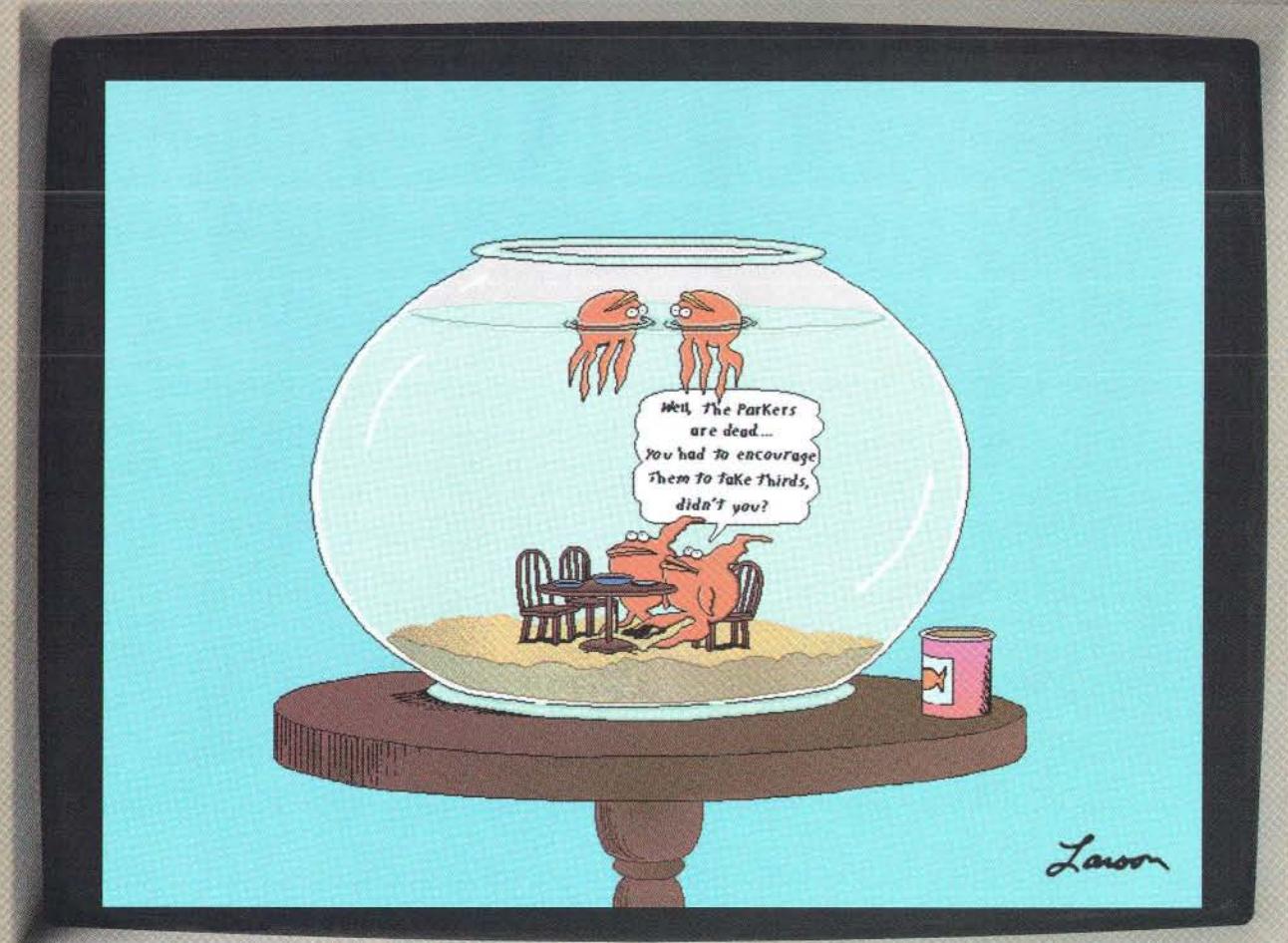
Just how many wiretaps per year are there?

The legislation is designed to facilitate wiretaps the government says it cannot implement. During 1992, according to a government report, there were 919 wiretaps authorized (no requests were denied). There were 607 individuals convicted as a result of these wiretaps — an infinitesimally small number when compared with the number of people convicted yearly in the US. Furthermore, the report does not specify whether any wiretaps were prevented because of advancing technology.

Why else should I be worried about this bill?

The bill requires industry standards groups to be formed to work with law enforcement in developing technical standards for these provisions. These standards bodies may not have been appointed yet, but will ultimately have incredible power. And these standards bodies will not necessarily receive any input from the public. ■ ■ ■

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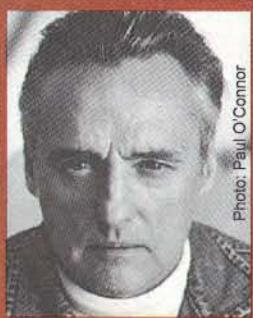


Photo: Paul O'Connor

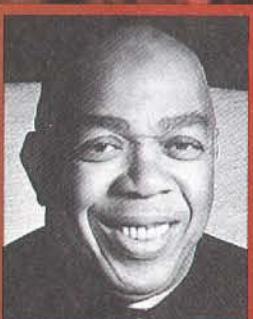
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Stephanie Seymour



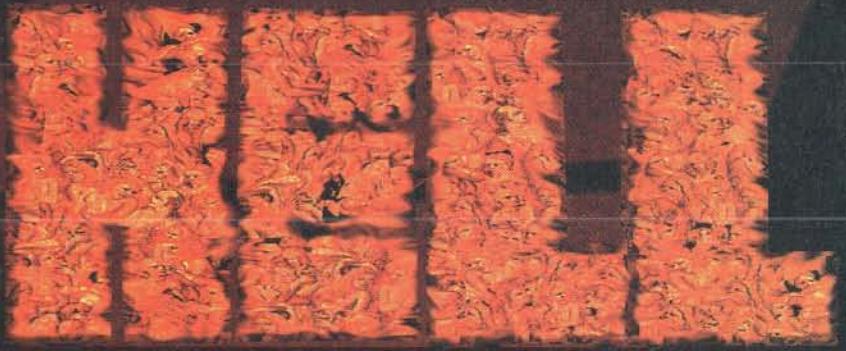
Grace Jones



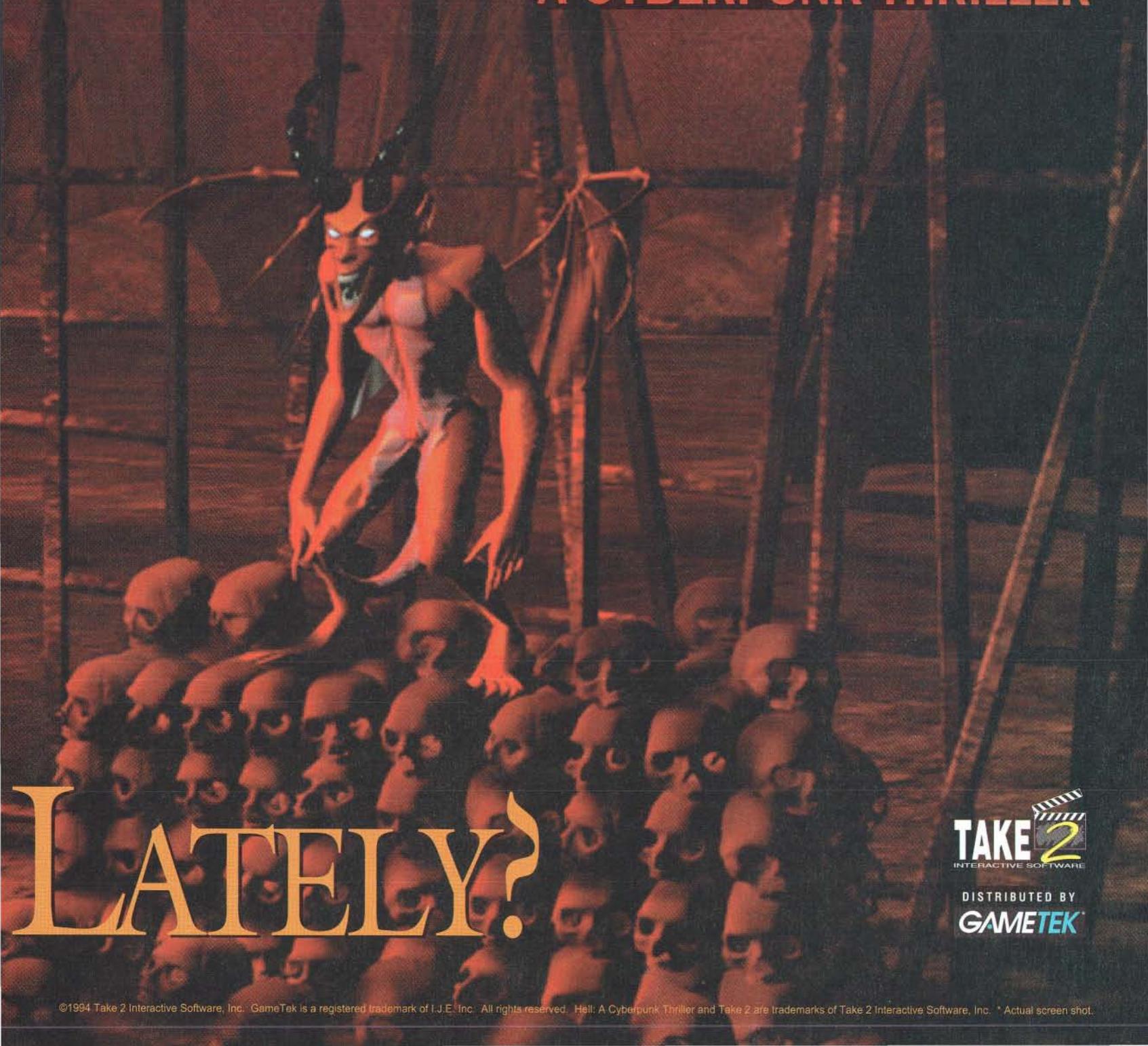
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Robot Obstetric Wards

Rudy Rucker penetrates the temple of the computing machine – the clean room at the chip fabrication plant – and discovers the place where robots reproduce themselves.

ELECTROSPHERE
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I fell in love with the Silicon Valley word "fab" the first time I heard it. This short, *moderne* word means "chip fabrication plant." A manager might, for instance, say, "What kind of outs are we getting from the fab?" In the '50s and '60s, of course, fab was short for "fabulous," as in the detergent Fab, or as in the lines in "Bob Dylan's 115th Dream": "I ran right outside and I hopped inside a cab. I went out the other door; this Englishman said 'fab.'" Gear! Kicky!

After exceedingly many phone calls, I managed to get

inside two fabs in Silicon Valley, one belonging to the chip giant Intel, and the other owned by Intel's small challenger, Advanced Micro Devices. AMD recently won a court battle with Intel over its right to produce the popular 486 processor chips for DOS- and Windows-based personal computers. Very much a

"we try harder" company, AMD was the first to let me into a fab – a quarter-billion-dollar building in Sunnyvale, California, called the Submicron Development Center.

A micron is a unit of measurement equal to one-millionth of a meter. A typical human hair might be a hundred microns wide. The scale of chips is discussed in terms of the size of the smallest features of the patterns on the chip. Today's chips use features about half a micron in size; hence, they are said to be using "submicron" designs.

AMD's Submicron Development Center was originally intended to be purely a research facility, but the demand for AMD 486 chips is such that the facility is now also being used for commercial production. It turns out to be crowded and a bit hellish in the AMD fab, which feels about the size of a wide office-building corridor plus maybe six offices on either side.

Something I hadn't initially realized is that being a fab worker is like being any other kind of assembly-line worker. It's a rigorous blue-collar job. Most of the workers are Asian or Latino. The AMD fab is open 24 hours a

day, every day of the year except Christmas – and in the Intel fab they work on Christmas, too. The workers pull 12-hour shifts, with three shifts one week and four shifts the next, for an average of 41 hours a week. Although some of the fab workers are highly paid engineers, starting pay for a simple technician is around US\$24,000 a year, which comes to about \$12 an hour.

What actually goes on in a fab? A fab buys blank silicon wafers and draws complicated patterns on them. This boosts a wafer's value from \$200 to \$30,000 or more. It's almost like printing money. The catch is that each of the many machines used in a fab costs more than a million dollars. And buying machines for a fab is complicated.

When a fab finishes a wafer, it is shipped to another plant, where the wafer is sawed up into chips and the chips are put into those familiar plastic cases with wires coming out. Such secondary plants are mostly in Southeast Asia – Silicon Valley fabs are solely concerned with printing the chips onto the wafers. To avoid dust, the wafers are shipped in vacuum-sealed bags.

The fab is a place for chips, not for people. People are dirty. Their bodies flake and crumble, generating showers of dust. One dust particle can ruin a chip, for instance, by shorting out the separation between two nearby submicron circuit lines.

With the current prehistoric state of robotics, there is no hope of fully automating a fab, especially given the fact that the process technology is subject to being changed over and over. So to deal with the necessary dirty people, the fab must be maintained as a clean room.

The room's cleanliness is specified in terms of the number of particles larger than one micron that can be found in a cubic foot of air. An average no-smoking restaurant might have a few hundred thousand particles per cubic foot. In a surgical operating room, the level is brought down to about 20,000. In the outer hallways of a fab building, the level is 10,000; in the wafer-handling areas of the fab itself, the level is brought down to one.

How? Here's the AMD procedure:

Dan Holiga, a member of the AMD corporate training division, is responsible for instructing new workers on clean-room procedures and for arranging science courses for them at local colleges. Dan leads me into the pre-gowning room. The floor inside the door is covered with sticky adhesive. I sit down on a bench and put some blue booties over my shoes so as not to track dirt into the locker room. The woman behind the counter can't find Dan's special fab badge, so she gives him a visitor badge like



Fabrication plants turn blank silicon into wafers worth US\$30,000 each. They might as well be printing money.



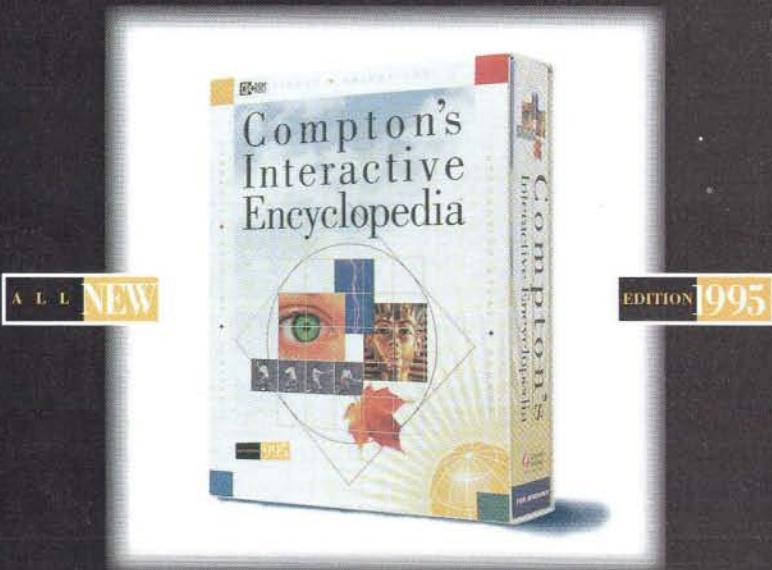
Mary thought the Playroom was certainly an eye-catching way to explore the multimedia content.



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mine. We select building suits in our sizes: these are two-piece suits that look like tight-cuffed blue pajamas. The woman gives us each some white plastic shoes that resemble bowling shoes.

In the pre-gowning room, we stash our street clothes in the lockers and put on the blue building suits and the white plastic shoes. We wash our hands and put on hair nets and safety glasses. Dan has brought a camera with him. We walk through a corridor into the outer hallway of the fab building. This is the 10,000-particles-per-cubic-foot zone, and the air feels cleaner than any I've breathed in a long time.

We pass a break room where some of the fab workers are having nondusty snacks like apple juice and yogurt. Then we go into a second locker room. I thought we were

grates, and the ceilings are filled with fans. There is a constant flow of air from above to below, with any showers of filthy human particles being sucked out through the floor grates. The air in the fab is completely replaced 10 times a minute.

I step out of the air shower and, fully purified, enter the fab. As the Bible says, "I was glad when they said unto me, let us go into the house of the Lord." I am in the temple of the God-machine of Silicon Valley. The lights are yellow to avoid clouding the photo-resist emulsions. This gives the fab a strange, underworld feeling. Air streams past me from ceiling to floor. Other white-garbed figures move about down the corridor; all of us are dressed exactly the same.

On the sides of the corridor are metal racks holding boxes or "boats" of wafers waiting for

touch each other to fill in nonverbal communication. Another factor could be that, since everyone is clean, there is no fear of getting yourself dirty through human contact. Or maybe it's just that you have fewer inhibitions with someone who is dressed exactly like you. In any case, the fab workers seem to have strong team spirit and a sense of camaraderie. They're like happy termites in a colony.

The craft of getting a hundred 486 or Pentium chips onto a silicon wafer involves laying down about 20 layers of information. It's a little like printing a silk-screen reproduction with 20 different colors of ink. At each step, a fresh layer of silicon dioxide is baked on, parts of the new layer are etched away, and metals or trace elements are added to the exposed areas.

As well as having to be positioned to an accuracy of one-tenth of a micron or better, the successive layers need to have a very specific thickness. Rather than being measured in microns, the thickness of the layers is best measured in nanometers, or billionths of a meter. Each layer is about 10 nanometers thick.

The process takes as long as 12 weeks for a completed wafer's worth of chips. It's not so much a linear assembly line as it is a loop. Over and over, the wafers are baked, printed, etched, and doped. At AMD, workers carry the boats of wafers up and down the corridor; at Intel's plant there is a miniature overhead monorail on which the boats move about automatically, like gondolas in a scale model of an amusement-park ride.

At AMD, I visit the etching bay first. There are a series of sinks filled with different kinds of acid piped up from tanks located on the story below the fab. In the bad old days, you could recognize fab workers by the scars on their necks from splashes of acid, but now there's a small industrial robot arm to dip the chips. I'm happy to see the arm; this confirms my sci-fi notion that fabs will ultimately be places where robots reproduce themselves: robot obstetric wards.

The acid baths are for removing the photo-resist masks after the etching itself is done. The etching is typically done "dry" – that is, a fine dust of ions is whipped into a frenzy with powerful radio frequency signals to make a submicron sandblaster. The idea is to dig out parts of the chip so that metal conductors and metal-doped semiconductors can be patterned in to make up the wires and transistors of the integrated circuit that the chip is to become.

Being in a fab plant reminds me of the "environmentally ill" fanatics you see in Berkeley natural food stores, wearing gas masks and elbow-length gloves. But I remind myself, this isn't about lunacy here, this is about objective scientific fact: getting down to one particle of dirt per cubic foot of air.

already dressed for the fab, but that was just the start. The second locker room is the gowning room proper.

Here we put on latex gloves. Then we wipe off our safety glasses and our visitor badges and Dan's camera – wipe everything three times with lint-free, alcohol-soaked cloths. We put on white hoods and "bunny suit" overalls made of Fibrotek, which is a sandwich of nylon and Teflon. We pull "fab booties" over our shoes, and we put on face masks. We pull vinyl gloves over our latex gloves. This is starting to feel a teensy bit ... obsessive. I'm reminded of the "environmentally ill" fanatics you see in Berkeley natural food stores, shopping while wearing gas masks and elbow-length gloves. They'd love it here in the gowning room. But, I remind myself, this isn't about fanaticism here, this is about objective scientific fact: getting down to one micron-sized particle of dirt per cubic foot of air!

Now Dan leads me through the air shower, a corridor lined with air nozzles blasting away. We hold up our hands and turn around, letting the air wash us all over. The invisible particles still adorning our bodies fall to the floor, where they are sucked away. In the air shower and in the fab, the floors are coarse

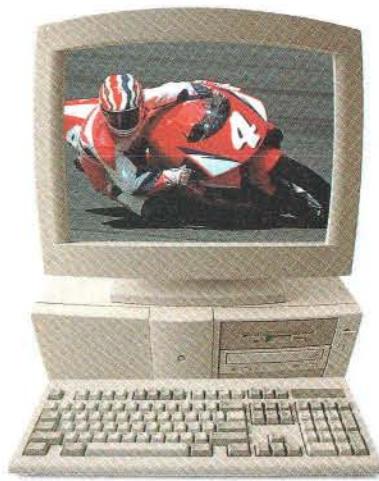
the next stage of processing. The racks have wires instead of shelves – there are in fact no flat horizontal surfaces at all in a fab; such surfaces collect dust and interfere with the air flow.

The only hint of human contamination is the meaty smell of my breath, bounced back to me by the white fabric face mask I'm wearing. I wish I could tear off the mask and breathe the clean, pure air of the chips. But then I would exhale, and the wafers wouldn't like that – detectors would notice the increased number of particles per cubic foot, and lights would flash.

The layout of a fab is a single main corridor with bays on either side. To keep the bays clean and uncluttered, most of the machines are set so that their faces are flush to the bay walls, with their bodies sticking out into sealed-off corridors called "chases." Like people, machines have bodies whose exigencies are not fully tidy. The chases are clean only to a 10-particles-per-cubic-foot level.

As we move down the main corridor to start our tour, people recognize Dan and come over to pat him on the back or on the arm. Dan's theory is that in the clean room, people can't see each other's faces, so they

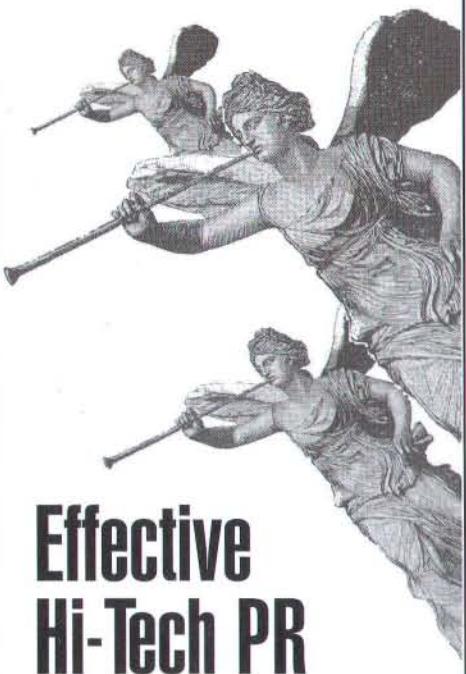
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The real center of a fab is the photo-lithography bay. Here the gel called photo-resist is sprayed onto the wafers, and then the wafers go into a "stepper," which is the machine that projects the circuit diagrams onto the wafer's chips. The projector is called a stepper because it projects the same image 100 times or so onto each wafer, moving the wafer in steps to receive each successive image. Steppers are the most expensive devices in a fab. The images projected by the steppers are found on transparencies called "reticles." Reticles are based on circuit diagrams created by engineers using computer-drafting techniques.

Once a wafer gets out of the stepper, a developer chemical removes the photo-resist that was exposed to light, leaving masks shaped like the dark regions of the reticle. This is a very efficient process, because

**It's great to stop inhaling
my own breath. It would be
tough to spend 12 hours
at a time in the fab. And for
\$24,000 a year! The dirty
secret of capitalism is that
the less they pay you, the
harder you have to work.**

although a reticle may have thousands of features on it, projecting its image onto the wafer puts all those features there at once.

The better the stepper, the smaller the images it can make. Smaller chips run faster, use less power, and can be produced in larger batches – more chips per wafer. In order to handle very small feature sizes, steppers need to use light with very short wavelengths – the current ones use deep ultraviolet, and, to get much smaller, the steppers will have to start using X-rays.

The light is mellow yellow in the bay with the steppers, where I find the most people clustered. This is the heart of the temple. Some of the workers are debugging a problem with one of the machines that sprays on the photo-resist; one of them is lying on the grated floor with a laptop computer. It strikes me that in this world, the floors are not dirty.

There are a couple of men with an electron microscope looking at wafers. One of them is holding a handful of wafers, some of them

cracked. "I guess those ones are no good?" I ask. The man looks at me oddly and finally grunts, "Yeah." Seeing only my visitor badge and not my expression, he thinks I'm an executive being sarcastic, but Don explains that I'm a journalist. The guy warms up then and has his co-worker show me some wafers under the electron microscope. There's a nice, clear image on a TV screen next to the microscope. It shows something like your usual image of a chip but with lots of parts missing. This is just one or two layers' worth.

"These things," the man with the microscope says, pointing to some fat short rectangles, "we call these the hot dog buns. And these other things," he points to some longer, thinner rectangles overlaid onto the fat short ones, "we call these the hot dogs. We check that the hot dogs are on the buns."

We peek into a few more bays. One especially cute little industrial robot catches my eye. Jerky and articulated like a shore-feeding bird, it folds its tail and pecks wafers out of their cartridges to slide them into some machine's maw. It reminds me of the animated Disney film of *Alice In Wonderland* – the part where Alice is lost in the woods near the Cheshire cat, and a little bird that looks like a pencil with two legs comes running up to her.

Dan takes some pictures of me, and then we go out into the gowning room to take off our face masks, gloves, and Fibrotek suits. It feels good to get out of that suit; I was getting hot. Also, it's great to stop inhaling my own breath. It sure would be tough to have to spend 12 hours at a time in a fab. And for \$24,000 a year! As a communist friend used to tell me in grad school: the secret of capitalism is that the less you get paid, the harder you have to work.

Now we're in our building suits again, and Dan wants to show me the sub fab, which fills the entire floor below the fab. As we go out into the building hall, a security guard in a clean-room suit runs up to us and asks our names. He writes our names on his glove; he's too excited to get the spelling right. He doesn't recognize Dan – we're both wearing visitor tags – and Dan is carrying a camera. Uh-oh. While the guard hurries off to make a report, Dan hustles me down the stairs to the sub fab.

The sub fab is a techno-dream. It holds all the machinery that supports the machines of the fab. The electrical generators are here, the plumbing, the tanks of acids, the filtering systems, the vacuum lines, the particle monitoring equipment – miles of wires and pipes

and cables in an immaculate 10,000-particle-per-cubic-foot concrete room. This is the ultimate mad scientist's lab. I'm enthralled.

Now here comes the clean-room security guard again. "You have to come with me." Dan wants to take some pictures first. "You have to come right away." The clean-room guard leads us out into a hall off the sub fab. Three unsmiling uniformed guards are there. Dan explains about his lost fab badge; they phone the pre-gowning room to go into Dan's locker and check out his ID; finally they decide it's OK, and we're back on our way.

"They thought maybe we were from Intel," Dan says. "Someone who doesn't know me saw us taking pictures in the clean room."

When I'm finally out in the dirty real world again, I'm grateful and glad. It feels as if I've been in the underworld, in some sort of gray limbo that seems too mechanical, a world in which people are totally out of place. I don't feel like turning on a computer again for several days. But I'm happy to have seen the central mystery.

Two weeks later, Intel finally comes through with a fab tour for me as well. My guide here is Howard High, of Intel Corpo-

rate Communications. The fab layout is quite similar to AMD's, although Intel's fab is much bigger – perhaps the size of a football field, and with high 15-foot ceilings to accommodate the wafer-boat-carrying monorails overhead.

The vibes in the Intel fab seem more relaxed than at AMD. Intel is ahead, and

The sub-fab room is the ultimate mad scientist's lab.

**Generators, tanks of acid,
vacuum lines, miles of wire,
cable, pipes. I'm enthralled.**

AMD is trying to catch up. At Intel, for instance, I don't have to exchange my clothes for a building suit: I'm allowed to just put the clean-room bunny suit on over my clothes. Because of dust, I wasn't allowed to use any paper on my AMD tour, but Intel issues me a spiral notebook of lint-free paper.

Rants aside, the more I learned about the fabs, the more I was amazed that they work.

The intricacy of the system is reminiscent of the complexity of a biological process like photosynthesis. Nobody could have designed one of today's fabs from scratch – these are giant industrial processes that have evolved, a step at a time, from earlier, simpler versions. There is a very real sense that these processes are the synthetic biology from which planet Earth's next great species may arise. ■ ■ ■

Even journalists have a tough time getting a fab tour – at Intel they told me the last person let in had been the vice premier of China. But Intel does have an informative museum near its fab, in the main building at 2200 Mission College Boulevard, off Montague Expressway, which is in turn directly off US 101 in Santa Clara (near San Jose). The museum is open to the public from 8 a.m. to 5 p.m., Monday through Friday. For info or tours, call +1 (408) 765 0503.

Rudy Rucker (rucker@sjsumcs.sjsu.edu) is an author and a mathematician at San Jose State University. His latest novel is The Hacker and the Ants.

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ELECTROSPHERE

The real private space program

is happening in garages across America. By Gareth Branwyn

It's early summer, 1994. I've come to Battle Park '94, an annual high-power rocket launch in Culpeper, Virginia. I want to see what the world of model rockets has been up to since I left the hobby in the 1970s. This weekend's event has drawn some 1,500 spectators from 31 states. We all park our lawn chairs and coolers in a cordoned-off

viewing area and settle down to watch the home-brew fireworks. From here, we'll be able to see as many of the 489 blastoffs as we can stand.

The sky is a soft, clear blue. The field that hosts the meet is a hard, dusty, exhausted-looking piece of American farmland. The sun is sweltering. Everyone's just sitting and sweating, heads permanently tilted skyward, squinting in anticipation of the next big takeoff. The engine sounds are shockingly loud, each launch fraught with a sense of anticipation, danger, and a little twitch of excite-

ment as the missiles scream to altitudes of up to 2.5 miles. Each rocket is quickly out of sight. Spectators hold their breaths until they hear a tiny "poof" sound, signaling that the parachute has popped out. When the rocket reappears, its owner rushes to the anticipated touchdown as everyone claps and points out the path of descent.

The place is a beehive of activity; plenty of booths sell food, and others display rocket kits, parts, magazines, engines, and T-shirts. Care to buy a 4½-foot plastic nose cone? It's a steal of a deal at only US\$98! There's a carnival atmosphere here, a carnival for nerds. The popular T-shirt of the day reads: "As a matter of fact, I am a rocket scientist."

Long lines of mostly men and boys – with jumbo rockets proudly tucked under their arms – march out to the three launch areas. (Sigmund Freud, call your office.) Some are so large they require two people to carry them to the pad. The launch areas contain rows of metal tripods, topped by round blast plates with tall launch rods protruding from their centers. Of the three areas, the one

farthest from the crowd, Area C, is set aside for the really high-power craft. These rockets stand from 6 feet to 12 feet tall when upright on the pads. Their makers crouch beside them, connecting wire clips to igniters sticking out from each rocket's motor (actually, often several motors in a cluster).

In basic model rocketry (the kind you may remember from your childhood), engine sizes are designated with letters A, B, C, D, and E, with each letter denoting twice as much power as the previous one. In the high-power rockets flown nowadays, engine sizes range from F to O. Depending on the weight and design of the rocket, clustered combinations of these motors can take a rocket to an altitude of between 10,000 and 20,000 feet (about 2 to 4 miles). Today's launch has a ceiling of 15,000 feet, because of the size of the field and its proximity to populated areas.

Once a rocket is all wired up to a central launch-control system, an announcer describes the rocket on the pad and begins a short countdown. The launch-control officer thumbs a switch, and electricity from a 12-volt battery flows to the igniter wires snaked into the business end of the motor. When enough juice is received and a spark is produced – SCHHHEWWW – the rocket blazes skyward. Unlike a kiddie model rocket, which leaves only a slight trail of exhaust, these vehicles generate copious smoke and hellfire.

Serious accidents are surprisingly rare in model and high-power rocketry. (When one does occur, rocketeers don't like to talk to journalists about it.) Although outright explosions are uncommon, there are plenty of crashes, misfires, and the occasional "land shark," which occurs when a rocket, still under full power, lands on the ground and begins skidding, leaping, and plowing its way through the dirt. If humans are caught in the rocket's path, things can get dicey. Another hazard is a "core sampler" or "yard dart" – when a rocket malfunctions and heads back to earth, drilling itself into the ground.

Here at Battle Park '94, the air is choked with burned rocket fuel. Long ribbons of smoke from the last few launches linger, drifting off toward the tree line. The announcer – er, "Launch Control" – starts running down the stats of the next vehicle on Pad C. It's a deluxe model, with air-start ignition (some of the engines are ignited later in the burn), radio-controlled chute deployment, and a cluster of very powerful engines. As he lists the engines' sizes and burn times, the crowd "oohs" and



How much bigger would a rocket have to be before it could reach the 50-mile boundary of space? That's a question every hobbyist ponders.

ment as the missiles scream to altitudes of up to 2.5 miles. Each rocket is quickly out of sight. Spectators hold their breaths until they hear a tiny "poof" sound, signaling that the parachute has popped out. When the rocket reappears, its owner rushes to the anticipated touchdown as everyone claps and points out the path of descent.

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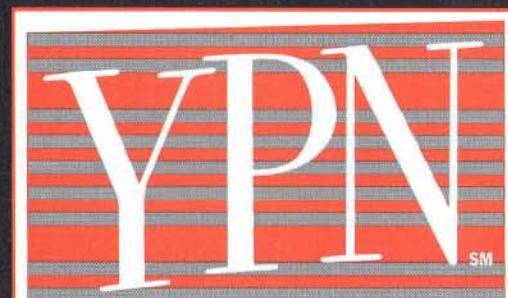


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"ahs." Onlookers sit a little straighter in their lawn chairs as the countdown begins. A fire engine from the Rapidan Volunteer Fire Department inches to the edge of the launch area. People are on their feet now. The rocket makes an obscene roar and plows into the sky. In an instant, it's gone. Completely out of sight. The crowd gasps and giggles. Launch Control shouts: "Folks, that one's headin' for orbit!"

Roll Your Own Space Program

Well, *that* one may not be headed for orbit, but how much bigger and more powerful would a rocket have to be before it could reach the 50-mile boundary of space? That's a question every rocket hobbyist ponders. Even though high-power rockets are many times larger and more sophisticated than the rockets I fooled around with as a kid, the highest recorded launch is still only 59,000 feet (that's a little more than 7 miles, the realm of commercial airliners).

Is it even *possible* that a group of weekend rocket scientists working out of their basements and garages on shoestring budgets could actually launch a vehicle high enough

to reach space? The National Space Society, a Washington, DC-based grass-roots space advocacy organization, thinks so. The national group recently struck a deal with the Pacific Rocket Society, a Southern California amateur rocket club, offering to finance the society's launch of the world's

space program cost? "We've raised \$10,000 to cover fuel and materials," says Margaret Jordan, a National Space Society vice president and the mastermind behind the project. "That doesn't count the labor being provided by PRS, which would cost at least \$50,000."

The Reaction Research Society maintains a Mojave, California, test site (right) and is experimenting with a 10,000-pound-thrust engine.

first amateur space vehicle. The deal calls for the society to design, build, and launch a rocket capable of delivering a 10-kilogram payload to an altitude of 80 kilometers (about 50 miles). The Pacific Rocket Society has also agreed to simultaneously build a second space-capable vehicle to launch if the first one fails. And what will such a garage

Amateur Right Stuff

Within the world of home-brew rocketry are three basic categories: model rocketry, high-power rocketry, and amateur – or experimental – rocketry. Model rocketry refers to the small rockets people tend to associate with Scout jamborees, grade-school science classes, and the Estes Industries rocket catalog that was advertised in the backs of comic books in the '60s and '70s. Estes is still around, and is still the main model rocket maker in the US. With an estimated 1.5 million model rocketeers nationwide, the hobby continues to thrive. Although plastic parts and pre-assembled models are more common, most rockets are still built from cardboard, balsa wood, glue, and paint and are powered by commercially manufactured black-powder motors. Making your own motors and using metal parts are still consid-



NOTHING ATTRACTS LIKE THE IM



CORIANDER SEEDS FROM MOROCCO



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JUNIPER BERRIES FROM ITALY



CASSIA BARK FROM INDOCHINA

ered big no-nos by the National Association of Rocketry, the organization overseeing the hobby and setting its safety standards. Altitudes reached by these tiny spacecraft haven't changed much either - 2,000 feet is still considered a high flight.

High-power rocketry became official in 1986, when the Tripoli Rocket Association was formed. This national organization was created to meet the needs of a growing breed of hobby rocketeers seeking more power and fewer restrictions on weight, materials, and launch altitudes. These hobbyists wanted to push the bounds of the possible and move up a rung on the ladder of sophistication and altitude. In high-power rocketry, the engines are still commercially manufactured, never homemade. They're a composite of ammonium perchlorate and synthetic rubber, the same materials used in the space shuttle's solid rocket boosters. They are powerful enough to carry 6- to 10-foot rockets to altitudes of 10,000 to 20,000 feet. While model rockets cost only a few dollars to build and fly, high-power rockets can cost hundreds to build and sometimes thousands to fly (for the biggest motors). High-power also makes

more extensive use of micro-electronics, on-board computers, radio-controlled recovery systems, and even miniature video cameras. High-power enthusiasts come from all walks of life. Many are employed in the aerospace industry or are frustrated armchair space

abandoned in favor of experimentation with metal airframes; homemade, often liquid fuels; and flights logging significant mileage. The faint-hearted would not dare undertake such a serious, often dangerous, endeavor.

Which brings us back to the Pacific Rocket Society.

A group of experimental rocketeers, the Pacific Rocket Society is one of the oldest rocket clubs in the country. Its membership includes a large number of engineers and aerospace students, who trace their lineage to the Glendale Rocket Society, an experimental rocketry group formed in the 1940s. Over the years, the group has undertaken a number of projects aimed at exploring the limits of amateur space technology. Members have always fantasized that one day their efforts might culminate in a full-blown space launch. Since 1985, they have been working with liquid-propelled rockets in the hopes of building a high-altitude vehicle. In 1987, a rocket they designed and built around a nitric acid/furfuryl alcohol engine reached an altitude estimated at 20,000 feet. In 1990, they began work on a new project, a rocket they dubbed HARV (High Altitude Research Vehi-



engineers wanting a piece, however modest, of the action.

Garage space efforts start to get interesting in the realm of what's called "amateur rocketry." Here, the rules of the air established by the National Association of Rocketry are

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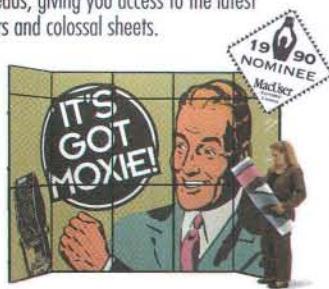
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ELECTROSPHERE

cle). Although they were confident HARV could reach an altitude of 100,000 feet (about 19 miles), the rocket was never completed. It will probably be used in some fashion as a test vehicle for the upcoming amateur space launch.

The society has divided into two groups, each working on the design of a space-capable vehicle. The vehicle that Pacific Rocket Society President Charles Pooley gets excited about is the Spacefarer X80 (X80 meaning exceeding 80 kilometers, or about 50 miles). The preliminary design for the vehicle marks the height of simplicity and funky makeshift

sors and status switches. A microgravity experiment, being prepared by a group from Mexico, may also hitch a ride on the vehicle. A video camera in the nose cone will downlink images to amateur television equipment on the ground. The ground-control system will be nothing more than a laptop PC. The entire payload is being designed by Duncan Cumming, a ham radio operator living in Rancho Palos Verdes, California.

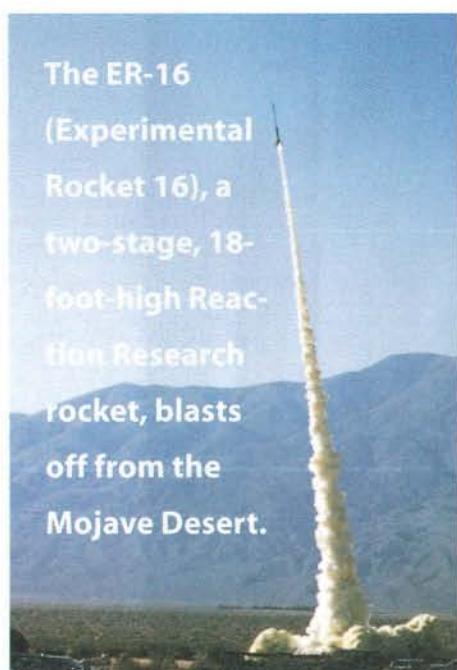
The Smithsonian's Air and Space Museum has already contacted the group about acquiring the Spacefarer X80 to display as the first amateur space vehicle. That is, if it flies, if it reaches space, and if it is recovered. Big ifs.

Educational Space

"This is just the beginning," says the always optimistic Pooley. "We hope this will raise the level of aspirations for other amateur rocketeers and stimulate a new type of grass-roots access to space." If the Pacific Rocket Society's launch (also called AmSpace I) is successful, it may be followed by an AmSpace II rocket, capable of taking 100 pounds to more than 100 miles. The National Space Society also sees as the long-term goal of this project a new level of interest in amateur and educational space efforts. "Right now there is no category for what's being done here," says Margaret Jordan. "In the eyes of the Department of Transportation, which licenses all space launches, you're either a commercial or a government entity. We would like to have a new category established—with special guidelines and regulations—for educational institutions and amateur researchers interested in developing new space technologies."

Chuck Kline, from the Commercial Space Transportation office of the Department of Transportation, says that such new guidelines and regulations are being studied. The department established guidelines for model rocketry in the mid-'80s, but the ambitions of today's amateur space groups have far surpassed the launch specifications addressed in those aging policies. "Those standards were set so that we wouldn't have to oversee every hobby launch in the country. Now, with the growth of amateur flights, although the numbers are still small, we're getting too many requests for launch waivers and we don't know how to handle them. We need to re-examine this whole area." The Department of Transportation is currently reviewing the joint amateur space launch.

At *Space News*, a weekly newspaper covering the space industry, reporter Andrew

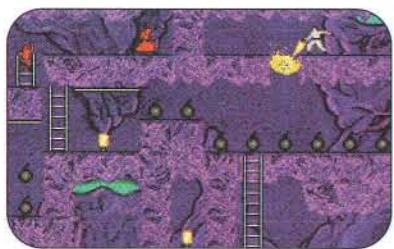


ingenuity. It uses cheap, readily available materials such as aluminum tubing for its liquid propellant tanks. Featuring an unconventional "tube-bundle" design, the single-stage rocket will be fueled by liquid oxygen and ethyl alcohol. Other innovations include an "air-braking" system of little pop-out panels to help decelerate the rocket at peak altitude. Many of the electronic components, possibly including the "fluxgate magnetometer" used for steering the glider, will come from the neighborhood Radio Shack. The liquid oxygen will be purchased from a local welding-supply house. Finished and ready for launch, the amateur vehicle will be about 20 feet high and 13 inches wide and will weigh in at about 600 pounds.

At the heart of the Spacefarer's payload will be a 6303 computer brain with a whopping 8Kbyte of memory, connected to a Rockwell Global Positioning System, an accelerometer, an altimeter, and other sen-

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Lawler is sympathetic to the joint project but has questions about how the government will respond to a burgeoning amateur space movement. "I have a feeling this just hasn't caught the attention of anyone in the State Department," Lawler tells me. "The government is keenly interested in preventing the international migration of missile technology. The educational benefits are obvious, but the government may not be very enthusiastic about losing control over this type of development."

The National Space Society is sympathetic to government concerns. "They certainly wouldn't want powerful missile-sized rockets over US airspace without their knowledge," says Jordan. "But we're talking about responsible research and development. This is noble work in the tradition of Robert Goddard and other early rocket pioneers."

The affable Charlie Gunn, the National Aeronautics and Space Administration's director of launch vehicles, doesn't see an immediate problem with an increase in amateur space activity. "If these guys think they can do it, I think that's wonderful!" he says enthusiastically. "But hitting the boundary of space is one thing. If they think they're gonna get something into a usable orbit, that's something completely different. Then you get yourself into trouble in terms of amateurs flying vehicles over other countries. By UN agreement, if a rocket from one country lands in another country, the country of origin is liable. Having some rocket club's amateur spacecraft land in someone else's backyard, let's say, Cuba - now that would be a little embarrassing."

Is "Big Space" Shrinking?

"The shuttle program broke the back of NASA!" So proclaims a participant in a discussion on America Online about the state of the US space program. Others echo this sentiment with disparaging remarks about irresponsible and unfocused leadership, overly complex and grossly expensive vehicles, and the resulting lack of public faith in NASA. "The only interesting things that've happened recently are the Hubble repair job and Clementine," says another contributor.

Clementine (see "A New Sense Organ for the Net," *Wired* 2.06, page 29) was the recent moon-mapping mission undertaken by a group of former star warriors at the military-backed Ballistic Missile Defense Organization who wanted to snub their noses at a bureaucratically strangled, out-of-touch NASA. The partially successful mission was

completed for \$75 million (dirt cheap) and its mission control was a warehouse in a rundown section of Alexandria, Virginia. While the mission has sparked much public debate over why the military would undertake such a project, most space enthusiasts agree that the modest cost and the innovative low-end approach are heartening.

Clementine seems to have sparked enthusiasm in the space community, suggesting that "cheaper, faster, better" may be more than just a Star Wars-era sound bite.

In fields from artificial intelligence to robotics, top-down centralization is yielding to bottom-up, decentralized, and small-scale approaches. Could widespread availability of cheap materials and powerful electronics, greater access to technical information and expertise, and the ability to coordinate efforts over the Net spur a similar revolution in space development?

Recent trends within the space industry are pointing to increasing interest in a "small is pragmatic" approach. There's a whole new breed of small launch vehicles, such as Orbital Sciences's Pegasus and Lockheed's LLV, being developed for low-cost space trucking. These vehicles can provide transportation to an emerging small satellite industry, typified by programs like Motorola's Iridium Project and the Globalstar effort. This new generation of small, low, Earth-orbiting communications satellites can provide instantaneous voice and data links anywhere on the planet. A number of space engineers are even proposing the idea of chip-sized satellites. Microminiaturization would allow orbiting battery-powered microchips to handle many of the functions of a larger conventional satellite. Swarms of these micro-sats could then be synchronized to function together - as a huge antenna, for instance.

Amateur Satellites?

Several other amateur groups are also eyeballing the stars from their garages. Another California group, the Reaction Research Society, is experimenting with a 10,000-pound-thrust, liquid-propellant engine that could be used as part of a future launch vehicle. A number of the society's members work in the space industry, and they take their amateur efforts seriously. They maintain a surprisingly sophisticated launching and test area in the Mojave Desert (which the Pacific Rocket Society also uses). Reaction Research was recently approached by AeroAstro Corp., a Virginia-based small-satellite company, about building a micro-sat launch vehicle

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engine. Rick Fleeter, president of AeroAstro, got his start as an amateur, building breadbox-sized satellites on his kitchen table.

Amateur satellites like Fleeter's have been around for years; in fact, there's an international organization of hobby satellite builders called AMSAT. Members design and build functioning experimental communications satellites and then cadge rides for them on US, European, Russian, and Japanese government flights. There are about a half-dozen of these amateur sats currently in orbit. Some of them function as "flying mailboxes," allowing ham radio operators to connect a computer to ham gear and upload e-mail messages for later downloading onto the Internet.

If any of the amateur rocket groups successfully reach orbit, one can imagine putting these two programs together and creating a new, ultracheap space transportation system to deliver tiny satellites into orbit. But that's still pure fantasy. While increasingly sophisticated amateur space activities may eventually converge with the downsizing end of commercial and government space, Charles Pooley points out that a low-end commercial launch vehicle is some 100 times

heavier and more powerful than a rocket like the Spacefarer.

Still, space payloads are shrinking. According to NASA's Charlie Gunn, the agency will soon seek bids on a new ultra-light launch vehicle that will be one-half the size of Pegasus, the small fry of launch vehi-

"Thanksgiving weekend." "The launch date is the 5th of ASAP," chuckles an unflappable Pooley. Given the laid-back nature of the project, and the fact that at press time they don't even have a launch waiver from the Department of Transportation, even the November date seems optimistic. But who knows? In the

For more information, contact Charles Pooley of the Pacific Rocket Society at ckp@netcom.com or check out the Students for the Exploration and Development of Space's World Wide Web page: <http://seds.lpl.arizona.edu/seds/seds.html>.

cles. "The payloads are movin' down," he says. "Everything's getting smaller and more lightweight."

The Little Rocket That Might

So, what is the launch date of America's first amateur space shot? That depends on who you talk to. Pacific Rocket Society member George Morgan first told *Wired* it would be

world of amateur space, all you need are some ferocious all-nighters, a few phone calls, and a sunny day — and you might end up in the launch vehicle business. ■ ■ ■

Gareth Branwyn (garethb2@aol.com) is senior editor of bOING bOING magazine and the creator of the HyperCard program Beyond Cyberpunk.

DAVID CRISALLI

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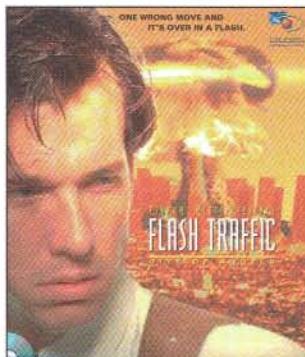
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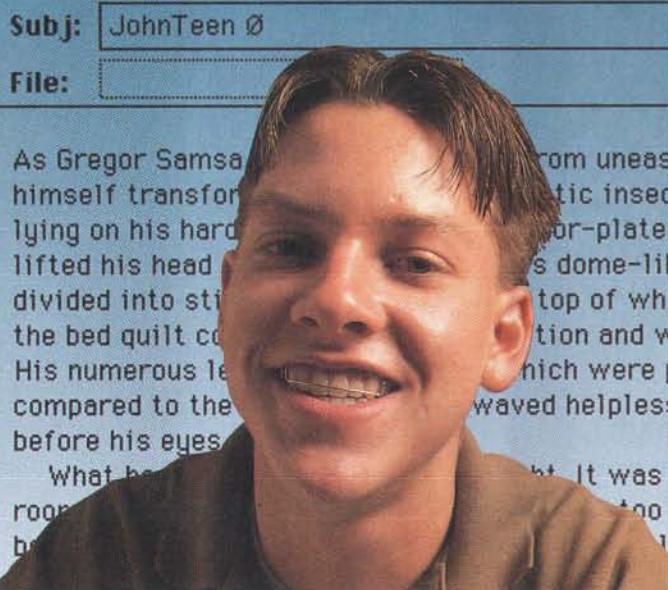
We're Teen, We're Queer, and We've Got E-mail

In the past, teens had to wait until they were old enough to get into a bar to meet other gays and lesbians. Now, online interaction lets teens find other gay youngsters – as well as mentors. By Steve Silberman

There's a light on in the Nerd Nook: JohnTeen Ø is composing e-mail into the night. The Nerd Nook is what John's mother calls her 16-year-old's bedroom – it's more cramped than the bridge of the Enterprise, with a Roland CM-322 that makes "You've got mail" thunder like the voice of God.

John's favorite short story is "The Metamorphosis." Sure, Kafka's fable of waking up to discover you've

morphed into something that makes everyone tweak speaks to every teenager. But John especially has had moments of feeling insectoid – like during one school choir trip, when, he says, the teacher booking rooms felt it necessary to inform the other students' parents of John's "orientation." When they balked at their kids sharing a room with him, John was doubled up with another teacher – a fate nearly as alienating as Greゴor Samsa's.



The messages that stream back into John's box are mostly from kids his own age, many marooned far from centers of gay and lesbian culture.

The choir trip fiasco was but one chapter in the continuing online journal that has made JohnTeen Ø – or as his parents and classmates know him, John Erwin – one of the most articulate voices in America Online's Gay and Lesbian Community Forum.

From: JohnTeen Ø
My high school career has been a sudden and drastic spell of turbulence and change that has influenced every aspect of life. Once I was an automaton, obeying external, societal, and parental expectations like a dog, oblivious of who I was or what I wanted. I was the token child every parent wants – student body president, color guard, recipient of the general excellence award, and outstanding music student of the year. I conformed to society's paradigm, and I was rewarded. Yet I was miserable. Everything I did was a diversion from thinking about myself. Finally,

last summer, my subconsciousness felt comfortable enough to be able to connect myself with who I really am, and I began to understand what it is to be gay.

JohnTeen Ø is a new kind of gay kid, a 16-year-old not only out, but already at home in the online convergence of activists that Tom Rielly, the co-founder of Digital Queers, calls the "Queer Global Village." Just 10 years ago, most queer teens hid behind a self-imposed don't-ask-don't-tell policy until they shipped out to Oberlin or San Francisco, but the Net has given even closeted kids a place to conspire. Though the Erwins' house is in an unincorporated area of Santa Clara County in California, with goats and llamas foraging in the backyard, John's access to AOL's gay and lesbian forum enables him to follow dispatches from queer activists worldwide, hone his writing, flirt, try on disposable identities, and battle bigots – all from his home screen.

John's ambitions to recast national policy before the principal of Menlo School even palms him a diploma (John's mother refers to him as her "little mini-activist") are not unrealistic. Like the ur-narrative of every videogame, the saga of gay teens online is one of metamorphosis, of "little mini" nerds becoming warriors in a hidden Stronghold of Power. For young queers, the Magic Ring is the bond of community.

John's posts have the confidence and urgency of one who speaks for many who must keep silent:

The struggle for equal rights has always taken place on the frontier of the legal wilderness where liberty meets power. Liberty has claimed much of that wilderness now, but the frontier always lies ahead of us.... The frontier of liberty may have expanded far beyond where it began, but for those without rights, it always seems on the horizon, just beyond their reach.

And the messages that stream back into John's box are mostly from kids his own age, many marooned far from urban centers for gay and lesbian youth. Such is Christopher Rempel, a witty, soft-spoken Ace of Base fan from (as he puts it) "redneck farmer hell." Christopher borrowed the principal's modem to jack into a beekeepers BBS and gopher his way to the Queer Resources Directory, a multimeg collection of text files, news items, and services listings.

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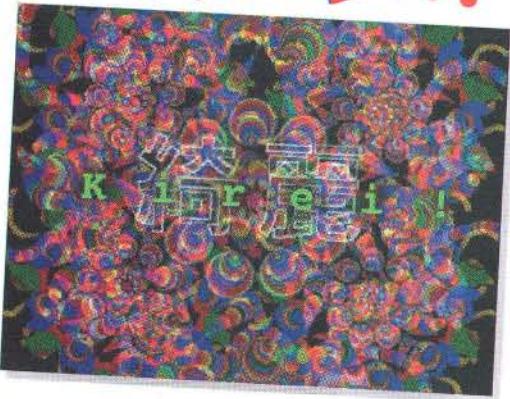
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My name is Christopher and I am 15 years old. I came to terms that I was gay last summer and, aside from some depression, I'm OK. I am *not* in denial about being gay.

I would like to write to someone that I can talk to about issues I can't talk about with my friends. I don't play sports very much, but I make it up in my knowledge of computers. I am interested in anybody with an open mind and big aspirations for the future.

A decade ago, the only queer info available to most teens was in a few dour psychology texts under the nose of the school librarian. Now libraries of files await them in the AOL forum and elsewhere – the Queer Resources Directory alone contains hundreds – and

"If teen organizers succeed," says Tom Reilly, "everyone's gonna hear about it. This is the most powerful tool queer youth have ever had."

teens can join mailing lists like Queercampus and GayNet, or tap resources like the Bridges Project, a referral service that tells teens not only how to get in touch with queer youth groups, but how to jump-start one themselves.



Kali is an 18-year-old lesbian at a university in Colorado. Her name means "fierce" in Swahili. Growing up in California, Kali was the leader of a young women's chapter of the Church of Jesus Christ of Latter-day Saints. She was also the "Girl Saved by E-mail," whose story ran last spring on CNN. After mood swings plummeted her into a profound depression, Kali – like too many gay teens – considered suicide. Her access to GayNet at school gave her a place to air those feelings, and a phone call from someone she knew online saved her life.

Kali is now a regular contributor to Sappho, a women's board she most appreciates because there she is accepted as an equal. "They forgive me for being young," Kali laughs, "though women come out later than guys, so there aren't a lot of teen lesbians. But it's a high of connection. We joke that we're posting to 500 of our closest friends."

"The wonderful thing about online services is that they are an intrinsically decentralized resource," says Tom Rielly, who has solicited the hardware and imparted the skills to get

dozens of queer organizations jacked in.

"Kids can challenge what adults have to say and make the news. One of the best examples of teen organizing in the last year was teens working with the Massachusetts legislature to pass a law requiring gay and lesbian education in the high schools. If teen organizers are successful somewhere now, everyone's gonna hear about it. This is the most powerful tool queer youth have ever had."

Another power that teenagers are now wielding online is their anger. "Teens are starting to throw their weight around," says Quirk, the leader of the AOL forum. (Quirk maintains a gender-neutral identity online, to be an equal-opportunity sounding board for young lesbians and gay men.) "They're complaining. It used to be, 'Ick – I think I'm gay, I'll sneak around the forum and see what they're doing.' With this second wave of activism, it's like, 'There's gay stuff here, but it's not right for me.' These kids are computer literate, and they're using the anger of youth to create a space for themselves."

The powers that be at AOL, however, have not yet seen fit to allow that space to be named by its users – the creation of chat rooms called "gay teen" anything is banned. "AOL has found that the word 'gay' with the word 'youth' or 'teen' in a room name becomes a lightning rod for predators," says Quirk. "I've been in teen conferences where adult cruising so overwhelmed any kind of conversation about being in high school and 'What kind of music do you like?' that I was furious. Until I can figure out a way to provide a safe space for them, I'm not going to put them at risk."

Quirk and AOL are in a tight place. Pedophilia has become the trendy bludgeon with which to trash cyberspace in the dailies, and concerned parents invoke the P-word to justify limiting teens' access to gay forums. At the same time, however, postings in the teens-only folder of the Gay and Lesbian Community Forum flame not only the invasion of teen turf by adults trolling for sex, but also the adults claiming to "protect" them by limiting their access to one another.

One anonymous 17-year-old poster on AOL dissed the notion that queer teens are helpless victims of online "predators":

There are procedures for dealing with perverts, which most teens (in contrast with most of the adults we've encountered) are familiar with. Flooding e-mail boxes of annoying perverts, 'IGNORE'-ing them in chat rooms, and shutting off our Instant Messages are all very

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The issue is further complicated by the fact that the intermingling of old and young people online is good for teens. The online connection allows them to open dialogs with mentors like Deacon Maccubbin, co-owner of Lambda Rising bookstore in Washington, DC. As "DeaconMac," Maccubbin has been talking with gay kids on CompuServe and AOL for eight years. One of the young people Deacon-Mac corresponded with online, years ago, was Tom Rielly. "Deacon was the first openly gay man I'd ever had a conversation with, and he

Accessing Queer Teen Cyberspace

- The Gay and Lesbian Community Forum. On America Online. Keyword: Gay.
- QueerAmerica. Send e-mail containing your city, state, zip code, area code, and age to ncglbyorg@aol.com.
- Queer Resources Directory. Anonymous ftp or gopher to vector.casti.com (look in pub/QRD/youth); On the World Wide Web, go to <http://vector.casti.com/QRD/.html/QRD-home-page.html>. Or send an inquiry to qrdstaff@vector.casti.com.
- Bridges Project. American Friends Service Committee referral and resource center. E-mail bridgespro@aol.com.

had a very clear idea of what his role was. He was nurturing and mentoring; he sent me articles; and he didn't come on to me," says Rielly. "I'll never forget it as long as I live."

In the past, teens often had to wait until they were old enough to get into a bar to meet other gay people — or hang around outside until someone noticed them. Online interaction gives teens a chance to unmask themselves in a safe place, in a venue where individuals make themselves known by the acuity of their thought and expression, rather than by their physical appearance.

When JohnTeen Ø logged his first post in the gay AOL forum, he expressed outrage that the concerns of queer teens — who are at a disproportionately high risk for suicide — were being shunted aside by adult organizations. His post was spotted by Sarah Gregory, a 26-year-old anarchist law student who helped get the National Gay and Lesbian Task Force wired up. "I really wanted to hit this kid between the eyes with the fact that a national organization saw what he was saying and cared that gay youth were killing themselves,"

Gregory recalls. A correspondence and friendship began that would have been unlikely offline — for, as Gregory says, "I don't notice 16-year-old boys in the real world."

Gregory explains: "I remember one particularly graphic letter I sent John in response to his questions. I wrote a huge disclaimer before and after it. But then I remembered how desperately I wanted to be talked to as an adult, and a sexual being, when I was 14. Thinking back, that's the point where John stopped sounding so formal, so much like a well-bred teenager talking to an authority figure, and became my friend. It's also the last time he talked about suicide. It scared me how easily his vulnerability could have been exploited, but I'd do it again in a heartbeat."

"I didn't even listen to music," moans John recalling his nerdhood, when the only thing he logged in for was shareware. Now the background thrash for his late-night e-mail sessions is Pansy Division. "To keep myself in the closet, I surrounded myself with people I'd never find attractive. I had two different parts of my life: the normal part, where I worked hard in school and got good grades, and this other part, where I was interested in guys but didn't do anything about it." For many kids, writing to John or to other posters is where a more authentic life begins:

Dear JohnTeen:

I am so frustrated with life and all of its blind turns. Am I gay? What will happen if I tell friends and my mom?... (I still don't 100% know that I am gay only that I am not heterosexual SO WHAT AM I) I really want to fit somewhere and also to love someone (at this point I don't care who).... Please EMAIL back and enlighten me. You have been very inspirational to me. I have no idea how you gained the courage to come out. Thanks, James

But John Erwin must guard against JohnTeen Ø becoming a full-time gig: he not only has the frontiers of liberty to defend and his peers to "enlighten," but like any 16-year-old, he needs space to fuck up, be a normal teenage cockroach, and figure out who he is. And he'd like to find someone to love. Does he have anyone in mind? "Yes!" he grins, pulling out his yearbook and leafing to a photo of a handsome boy who says he's straight.

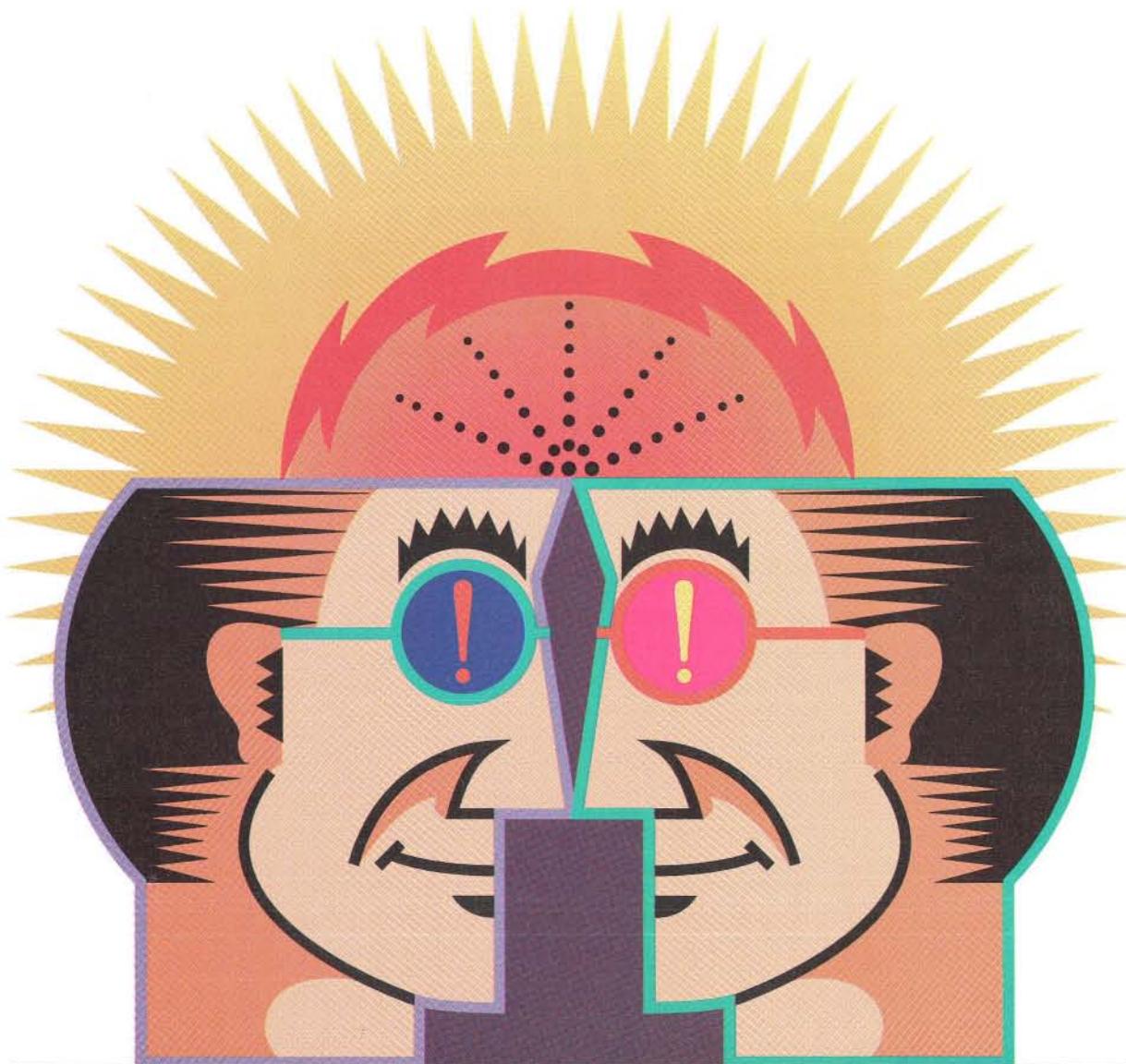
Is John's dream guy online?

"No. I wish," John says. "If he was online, I could tell him how I feel." ■ ■ ■

Steve Silberman (digaman@well.com) wrote Skeleton Key: A Dictionary for Deadheads.

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Hackers: Threat or Menace?

ELECTROSPHERE
BY CHARLES PLATT

That's what the press, the security apparatus, and the hackers themselves want you to think. But think again.

Wired attends Hackers on Planet Earth, the convention of phone phreak mag 2600, and discovers who Emmanuel Goldstein really is. By Charles Platt

A mob of scruffy, geeky guys is milling around on the 18th floor of New York City's Hotel Pennsylvania, in a dowdy old ballroom where many of the lightbulbs in the brass chandeliers are burned out. A beat-up audio system is making scratchy sounds while bearded sysop types try to link a bizarre mix of antique computing equipment into some sort of network with Internet access. The hardware is scattered around on tables.

There are no formal exhibits, no booths, no buffet, no coffee, no bar.

CNN and NBC are here, prowling like starved alley cats in search of some tasty leftovers. They cluster around a teenager wearing a black jumpsuit with flames hand-painted across his shoulders. He's soldering components onto a tiny piece of perf board. "What does it do?" a journalist asks, although there's a sense that his real interest may run a little deeper. Is the gadget *illegal*? Is it *scary*? Can it paralyze vast computer networks with a single pulse?

This is, after all, Hackers on Planet Earth, the so-called HOPE conference. There have been other hacker conventions, but this is the first to come right out and offer educational

seminars to the general public on such subjects as:

- Cracking the MetroCard, a magnetic-strip fare card recently introduced for the New York subway. "We will read the cards, duplicate them, and make every attempt to defeat the system," reads the conference program.
- Lock-picking. "Everything from picks to rakes to electric drills to Simplex locks."
- Boxing (i.e., free phone calls via blue or red boxes). "Contrary to popular belief, boxing is not dead. We will have some top phone phreaks on hand to show you what works, what doesn't, what used to work, what never did, and what probably might."
- Cellular phones. "We will show how cloning is not just for criminals and how you can clone a phone on your own PC!"

It all sounds titillatingly wicked. So where's the action? Where are the devious, unprincipled hackers committing illegal acts? *Where's the crime?*

The conference was scheduled to start half an hour ago, but so far the only action is out in the lobby, where hundreds of would-be attendees are squished together, back-to-belly, waiting patiently for nifty customized photo-badges, each of which, unfortunately, takes about 60 seconds to come out of a laser printer. There are maybe 600 attendees, so at this rate it'll take 10 hours just to check everyone in.

A friendly Dutch hacker with long golden hair and tie-dyed T-shirt devises an impromptu solution. He goes around selling red numbered pieces of paper as temporary badges, takes US\$25 per person, and stuffs the cash in a brown paper bag. No one has any problem with this. No one questions the Dutch guy's authority or doubts that he'll pass the money to the organizers.

And so it seems that the "devious, unprincipled hackers" are showing an amazing degree of naïve trust.

This is the first paradox. There are more.

Here's a well-fed, tough-looking character wearing shiny black shoes and a suit and tie. Hairy teenagers in sneakers, T-shirts, and dirty jeans come clustering around him like zoo animals sniffing a new keeper who just walked into their cage. A film crew zeroes in. This dude exudes an air of authority as he starts spitting out sound bites on the subject of national security. "You can cripple a nation very easily with just a few individuals... 13-year-old Pakistanis... Wall Street is hiding major losses... cyberspace is not safe right now... we need a national information strategy."

I ask him what he means by the word "strategy." Who devises it? Who implements it? Should it be law?

"Legislation is part of it," he agrees. He mentions that he himself has drafted a National Information Strategy Act of 1994. His name is Robert David Steele. He worked on the clandestine side of the CIA for nine years and subsequently advised Marine Corps intelligence. Al Gore has quoted him. And now, he's here to give the opening address at Hackers On Planet Earth.

When the speech gets started, Steele paints a scary picture of terrorist info-criminals, businesses with no data security, and banking networks that could be gutted overnight. Then, switching smoothly to a kinder, gentler mode, he asks the audience to help him fight these threats. "Hacking is not a criminal act," he says. "You represent a critical national resource.... I think of you as



Conference sideshow: a hacker solders components for a "red box," which imitates the sound of quarters falling into a pay phone.

law-abiding citizens who have immense potential to contribute to society."

The rumpled throng of misfit Netheads and rebel code crunchers seems oddly happy to hear this. They are generous with their applause. This is paradox Number Two: they smile upon this one-time agent, even when he mentions, in passing, "I used to persuade people to betray their countries for money, and I was very good at it."

The creator of the HOPE conference is Eric Corley, editor and publisher of *2600* magazine. (Its title harks back to days when a 2600 Hz tone worked like a can opener on the telephone system.) According to Corley, hacking is just a harmless expression of youthful curiosity. "I was brought up to ask questions," he told me in an interview before the conference. "This is all that hackers do. They just ask questions till they get an answer that's different. And I merely encourage that."

But in any issue of *2600*, you'll find a lot more answers than questions. Would you like to crack Unix systems, devise computer viruses, listen in on cellular phone calls, or break into UPS mailboxes? No problem! In

quick, easy lessons, Uncle Eric will tell you how! Likewise, if you browse through Corley's alt.2600 newsgroup on Usenet, you'll find enlightening discussions on topics such as how to steal cable TV, how to build a gadget to "bring Telco down to its knees," or how to monitor message traffic on an Ethernet. (A



reader writes: "Some packets might contain, uhm, especially handy info that I might want to extract....")

Corley has been publishing *2600* for 10 years. Recently, however, the magazine has turned into a growth industry. With newsstand distribution, its sales have jumped by 50 percent during the past 12 months alone. There's even a bunch of "2600 franchises"

up and running: local groups that meet simultaneously in 29 US cities and four foreign countries on the first Friday of every month, like a giant multinode Tupperware party for the naughty boys of cyberspace. Here you can find shifty-eyed teenagers hanging out, swapping secrets, and maybe spreading a little playful disinformation on the side.

Dark Fiber (left) examines his stolen copy of the administrator's guide to the New York City MetroCard system.

Is this scary? Corley shrugs it off. His magazine merely repackages information that exists elsewhere, and, as for the HOPE conference, he says with straight-faced sincerity that it's a modern manifestation of "the spirit of Woodstock."

Publicly, Corley goes under the pseudonym "Emmanuel Goldstein," the name of a character in Orwell's *1984* who was the leader of an underground movement to overthrow Big

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**Steele figures he needs US\$1 billion per year
to pay for his plan, but he says he only wants to establish and rationalize
the information services, not control them. He seems, in fact, like Santa Claus.**

Brother. So here we have a 30ish guy with shoulder-length curly black hair, wearing a 2600 T-shirt and a baseball cap, skulking around like the Phantom of the Opera, evading direct questions, and habitually glancing behind him as if he expects to be arrested at any moment. He implies that hacking is as harmless as ham radio, yet he names himself after a character who was Public Enemy Number One in the most famous totalitarian scare-novel of our time.

Paradox Number Three.

One thing is certain: system hacking, today, is entering a new era.

In the early 1970s, phone phreaks manipulated the long-distance system using blue boxes that they built from sketchy photo-

copied schematics that were often riddled with errors. Not many had the skill to do this. Phreaking was restricted to a select few.

By 1980, hacking was done using Apple II computers and modems driven by home-grown assembly-language programs. Once again, few people were sufficiently skilled to participate.

Today, countless Unix sites are instantly accessible via the Internet. Unix is riddled with security loopholes, and you can practice hacking it in the privacy of your own home using Linux (a freeware Unix clone) on a cheap 486. You don't know Unix? No problem! *Unix for Dummies*, at your local bookstore, will get you started. Small wonder that 2600 local group meetings have grown exponentially in number.

Is this scary? Some more historical perspective may help to answer the question.

Twenty years ago, I used to drop in on meetings of TAP, the legendary phone-phreak affinity group in New York City. In a sleazy little office full of furniture that had been salvaged from the street, we stuck postage stamps on a badly duplicated newsletter and read correspondence from the jail cell of Captain Crunch, aka John Draper, the most infamous phreak of all.

It all seemed wonderfully subversive. Tom Bell, a key figure at the time, told me seriously that he avoided walking close to tall buildings in case telco agents should drop a file cabinet on his head. But in reality there was no significant threat either to or from the telephone company. The TAPPers were just a few misfits

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**As Barry Goldwater once said,
"A government that is big enough to give you
all you want is big enough to take it all away."**

fascinated by technology and looking for some token power over a world that didn't seem to like them very much. Their maximum level of criminal activity was somewhere between trespassing and shoplifting; hackers today seem much the same.

I liked hanging out with the phone phreaks because their rebellious behavior gave me a vicarious thrill. In this, I am not unique. As a nation, we have always been fascinated by the exploits of renegades, from Jesse James to James Dean, and we've elevated some of them into folk heroes. Seen from this perspective, our current fascination with "dangerous hackers" is just a new manifestation of an old tradition.

But public sympathy for rebels is a fickle thing. If the rebels pose a threat that strikes

too close to home, we feel no compunction about throwing them in jail.

So we come to paradox Number Four. The public is eager for stories of True Cyber-crime, and the media is happy to glamorize the subject. But when teenagers take the bait and live out our fantasies for us, we punish them for frightening us too much.

One of the amusing things about journalists (myself included) is that they tend to believe the myths they jointly create. Consequently, at the HOPE conference, almost every reporter seemed to be searching for a hacker who would fit the classic media model of a devious, sinister, powerful figure. The journalists were asking, in effect, Where's the crime? – and none of them could find any.

The conference was very bland, very laid-back. The attendees were totally nonthreatening. Even the "seminars" turned out to be rather lame, devoid of subversive content.

And yet, if you knew where to look....

Late Saturday night, slightly drunk and, frankly, bored by the harmlessness of the event, I found myself introduced to "Dark Fiber," a man in his 20s who had in his possession a certain document in a loose-leaf binder. He claimed that it was a system administrator's guide to New York City's new MetroCard fare collection system, and when he showed it to me, I saw that he was right. There were complete schematics, right down to the part numbers.

Dark Fiber was so pleased with his heist, he let me take his photograph holding the



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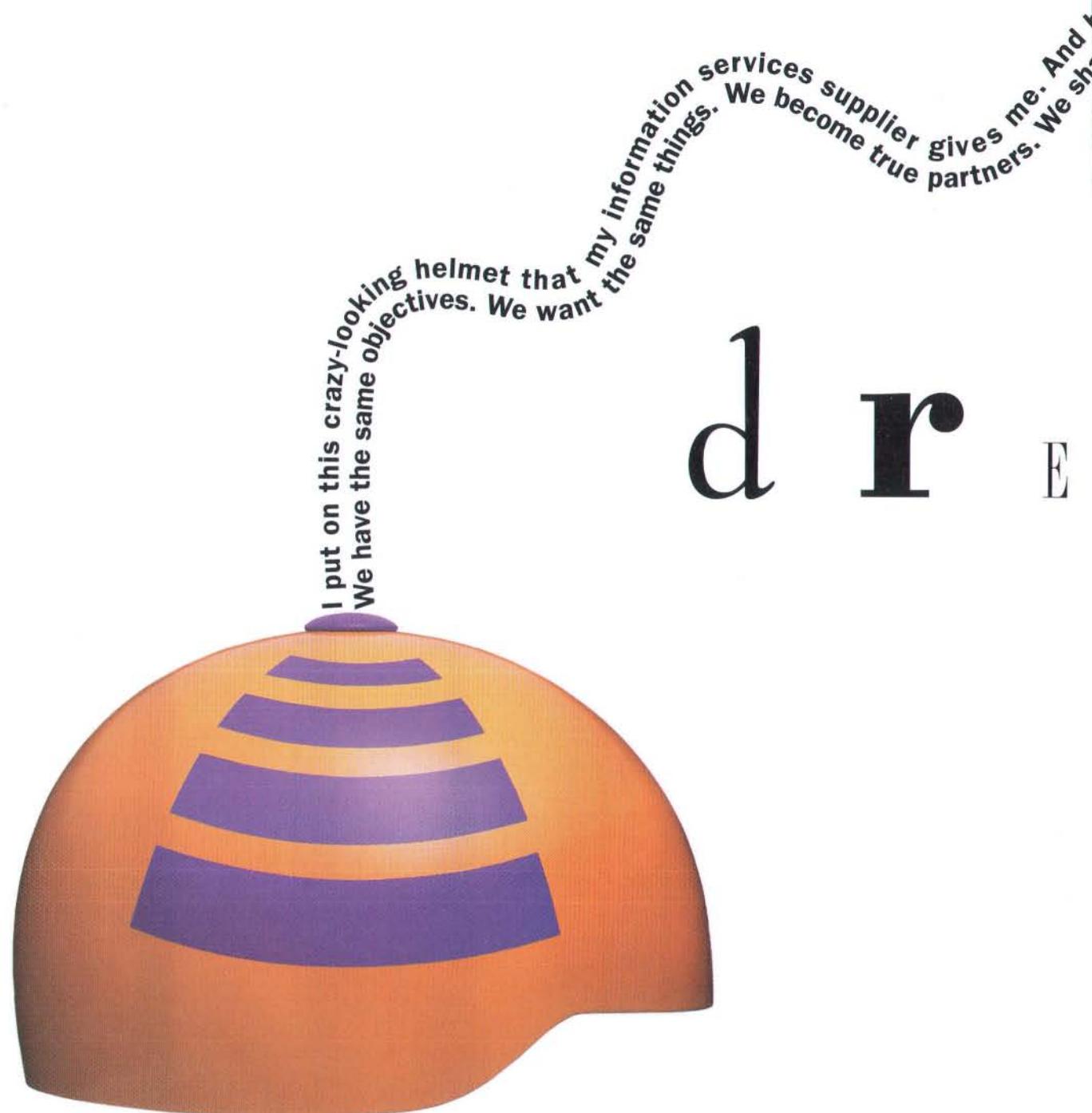
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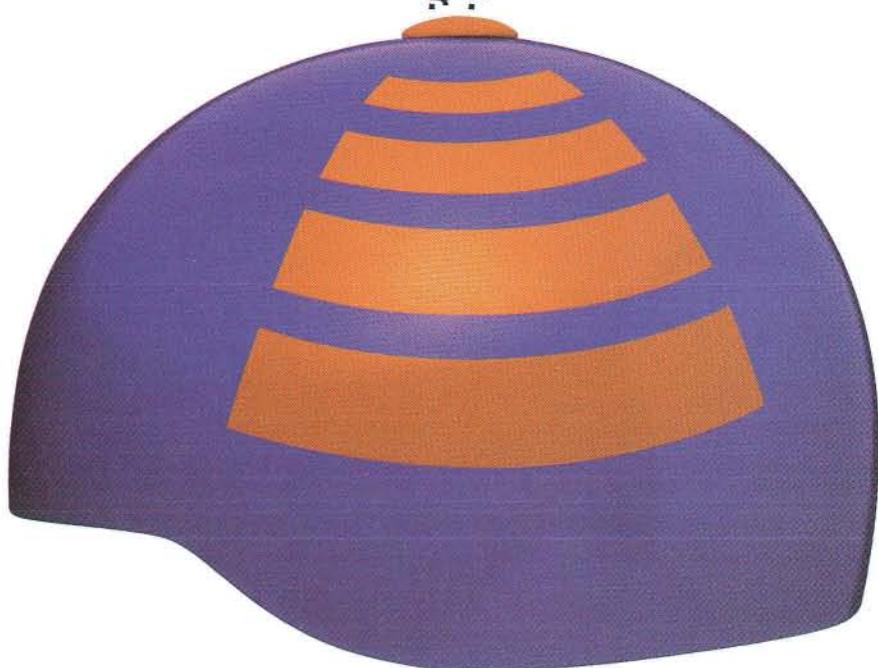


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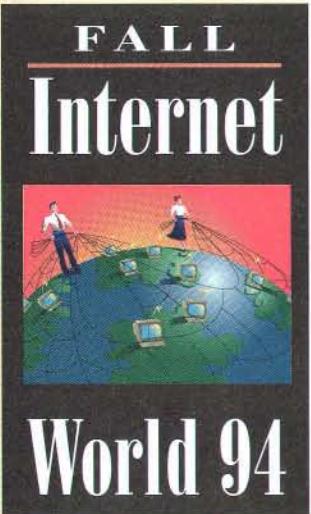


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binder, standing outside the Hotel Pennsylvania at 2 a.m. with the rain coming down. A few days later, he gave me a phone interview.

He told me that he'd been a systems hacker on and off for several years, working through the Internet, cracking Unix sites and Vaxen, just sneaking in and looking around. He agreed that hacking had become easier and more widespread than ever before, but he said that the dangers were still being exaggerated - with encouragement from the hackers themselves. "Most of them understand that the media are very easily spooked," he told me. "Some of them take advantage of this. It's what I would call testosterone-influenced braggadocio. They enjoy it."

But isn't there some real damage involved? "People have destroyed system files, wiped

**The public is eager for stories
of True Cybercrime, but when
teenagers take the bait, we
punish them for frightening us.**

out password files. Others just blundered in and corrupted data by accident. But if data is properly backed up, there's no physical loss, just a large amount of inconvenience."

I asked him what he planned to do with the document in his possession.

"I'll probably run it through a copying machine and distribute it to a select few hacker friends."

Sell it?

"I won't sell it." He sounded offended by the idea. "A true hacker never does that. One of the overriding tenets of hackerdom is that information wants to be free, and a lot of us take that very seriously. You have to understand, my motivation isn't to ride free on the subway. I was born and raised in this city, and I've always paid my way. I'd just like to understand the system a little bit better. It's a purely intellectual interest on my behalf."

But if he shares his info widely, that could cause the MetroCard system to be hacked.

"I think the system will be hacked, and eventually it will have to be improved to make it more secure. Nevertheless, I think this information should be available."

But if details of the improvements are also stolen and shared, electronic fare collection will never be feasible.

"I see the paradox, but this is a central theme in hacking in general. Where do you draw the line? Every hacker has to wrestle with his conscience."

I don't claim to be able to resolve all the contradictions here, but I did reach some personal conclusions about the people involved.

- The hackers at the HOPE conference were more trustworthy and less threatening than any "normal" crowd of teenage males whose idea of action on a Saturday night would most likely include drinking, driving, hassling women, and picking fights in bars. Hackers, in fact, tend to be quiet, shy, and honest. When a total stranger at the conference asked to borrow my new \$500 camera, I loaned it to him without a second thought and was only mildly concerned when he disappeared with it for a quarter of an hour. Compare this with a crowd at a baseball game or a rock concert, and you begin to realize that the "hacker threat" is about as scary as a kid wearing a Halloween mask.
- Eric Corley is one of the most evasive human beings I have ever attempted to interview, and his air of innocence doesn't quite jibe with the attitude and content of his magazine. Nudged by insistent questioning, he did finally admit to me that "I like to upset the status quo, challenge things that everybody agrees with.... I don't like monopolies or police."

He is in fact a troublemaker, but on a level that seems trivial compared with, say, trade-union organizers or anti-abortion activists. Moreover, by opening up the hacker subculture to the general public, Corley is devaluing his own currency. Any small group of diehard nonconformists tends to lose its power when the barriers come down. Hackerdom could turn into a harmless fad in the same way that radical hippie activism in the 1960s degenerated into a fashion statement after it received sufficient media exposure.

- Robert Steele is a far more complicated character. When I posted a mild inquiry about Steele's background on a Usenet newsgroup, I received e-mail from Steele himself, cautioning me about the damage that irresponsible journalism could do to the hacker community and warning me of his personal willingness to sue. Still, he also wished me well in my work, and I had the disconcerting feeling that I was dealing with good cop and bad cop rolled into one.

I wrote back to him, he responded, and our communications became more cordial. He encouraged me to quote his e-mail and told

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me with disarming frankness, "I do not want to be Director of 'Central' Intelligence, but I could get real excited about being Director of National Intelligence, with a subordinate Director of Classified Intelligence (DCI), and a subordinate Director of Public Intelligence (DPI) who serves as the head of the National Information Foundation, which in turn helps nurture our *distributed* network of databases and expertise." These titles and offices do not currently exist, but the US Senate bill that Steele has drafted would create them, along with the kind of universal Net access that other bills have promised.

Steele figures he needs \$1 billion *per year*

**A token-booth
clerk from the New
York subway sys-
tem discusses the
new MetroCard,
which was sup-
posed to be hacked
at the conference.**



to pay for his plan, but he says he only wants to establish and rationalize the information services, not control them. He seems, in fact, like Santa Claus, though we should remember that the annual \$1 billion would ultimately come from us, as taxpayers.

More to the point, even though Steele seems sincere in his desire for "free" information, others in Washington may be less benign. If we want to look ahead and see the future of a government-run infobahn, maybe we should check the status of the last project of this type: the interstate highway system. This started out as an unencumbered gift to the nation, but now has some significant strings attached. To take just one example: states used to have the authority to set their own speed limits and the legal age for drinking alcohol. Today, they must follow federal "guidelines" in these areas if they want to continue receiving federal highway funds. As Barry Goldwater once said, "A government that is big enough to give you all you want is big enough to take it all away."

As for the supposed escalation of the "hacker threat," a comparison may help.

In rural areas, there are thousands of miles

of railroad tracks, unfenced and easily accessible. Any disaffected teenager can put something on a track to derail a train. Kids frequently trespass on railroad property and occasionally tamper with the system; yet for some reason, this is no great cause for alarm. No one demands better railroad security or jail terms for trespassers.

Our information network is much better protected than our railroad network, and someone who cracks a system is able to cause far less human damage than someone who derails a train. Why, then, has "computer crime" caused so much hysteria? Perhaps because the public is so willing - eager, even - to be scared by bogeymen.

Journalists and politicians are well aware of this, and so was George Orwell. Near the end of 1984, Orwell's protagonist discovers that "Emmanuel Goldstein" does not actually exist. He's a fake, concocted by the totalitarian state to unite the people against a common enemy.

Scaremongering is an age-old political ritual.

There are public officials who have benefited by playing up the "hacker threat" so that they can win approval by cracking down on it. In a similar way, other people in public service may advance their careers by playing up the info-terrorist threat, the corporate-data-security threat, or the financial-institution threat.

I'm not trivializing these problems. They exist. But we will surely be better off if we keep them in proportion and take modest steps to solve them ourselves, rather than allowing a central authority to take control.

The Internet has undergone astonishing, almost catastrophic growth, yet it still works relatively well without anyone in control of it in the conventional sense. If it had been "properly organized" or made "properly secure" from the "hacker threat," it might not be thriving as vigorously and responsively as it is today. The trusting people at the HOPE conference, who were quite happy to pay \$25 for red pieces of paper, should perhaps drive a harder bargain when dealing with emissaries from Washington. ■ ■ ■

Charles Platt's (charles@mindvox.phantom.com) most recent work is The Silicon Man. He writes frequently for Wired.

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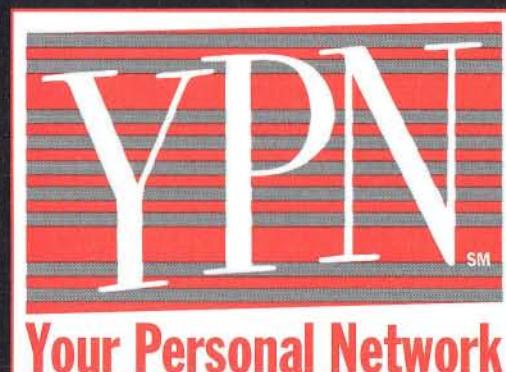
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Wanted: Net.Census

By Donna L. Hoffman and Thomas P. Novak

The current approach to estimating the population of the Internet is like estimating the number of people in the US by counting the buildings.

Gating electronic commerce are reluctant to invest in net.product development. Instead, with limited resources, investors may choose to direct funds to alternative new markets like so-called "interactive TV," which, though easier to measure and understand because they mirror traditional mass-media markets, do not possess anywhere near the Net's potential for growth, development, and reinvention of market systems.

And so the debate rages in the net.world – how many people are on the Internet? And more importantly, what are they *doing* there? Back in August, Peter Lewis's article in *The New York Times* threw doubt on the commonly cited number of 20 million to 30 million Internet users, suggesting that the real number might be in the low millions.

How did the Net community come up with such drastically different numbers? Easy: both figures are based on surveys that make unprovable and probably invalid assumptions.

The number of users of the Internet is currently measured using a two-step process: first, estimate the number of computers that act as Internet "hosts" or nodes, and second, estimate the numbers of users for each host. Lewis's *New York Times* article was based upon John Quarterman's TIC/MIDS Internet Demographic Survey, a survey administered via e-mail in January 1994 (<gopher://gopher.tic.com/00/matrix/news/v4/faq.406> if you want to see it). An alternative approach is Mark Lottor's Internet Domain Survey (<http://www.nw.com/zone/WWW/top.html>).

For statistical and qualitative reasons not worth boring you with, Quarterman estimates a lower bound of 1 million hosts and an upper bound of 1.4 million hosts whose users could access Internet services by July 1994. Lottor's July 1994 survey estimates a lower bound of 707,000 hosts and an upper bound of 3.2 million host computers on the Internet.

Upper and lower bounds aside, the important point here is that estimates of the number of Internet hosts for July 1994 ranged from 707,000 to 3.2 million, depending on assumptions made in calculating them. Estimates of the number of users per Internet host also vary consid-

Companies want to do business on the Internet, but so far it's proven a tough target for spreadsheet jockeys. Without accurate numbers indicating the Net's size and market potential, many firms investi-

erably. Quarterman concludes that there are "apparently about 3.5" users per host, but he notes that others have used numbers like 5, 7.5, and 10. No one seems to know for sure.

What happens when you multiply the number of hosts by the number of users per host? Depending on which numbers you select, you get something between 2.5 million and 32 million users. What you *don't* get is a good grip on the actual number of users. More importantly, both Lottor's and Quarterman's surveys focus on measuring numbers of machines, rather than numbers of people. Their surveys are not really designed to measure the number of users on the Internet, nor are they designed to provide any insight into what people are using the Internet for.

For his part, Lottor claims that he counts only domains and hosts and sees little value in counting the number of users. Others on the Internet share his view. A frequently heard comment is that only the 50,000 people who visit a particular Internet site are of interest – the greater issue of whether these 50,000 come from a total population of 2.5 million or 32 million is irrelevant.

This is shortsighted. It is foolhardy to be content with an "adequate" number of visits to a site. In the explosively evolving Internet environment, we expect that the novelty of many commercial sites will soon fade, and then the real competition to attract visits to commercial sites will begin. In this competitive environment, accurate information on market potential and user needs will be critical.

A Better Way to Measure the Size of the Net

Current approaches to estimating the number of users of the Internet are akin to estimating the number of people in the US by sampling the number of buildings, without regard to their function or contents. We propose a completely different way – rather than inferring the number of users by counting and sampling machines, sample the users themselves.

A given person may have access to many different computers – for example, a Unix machine in the office, accounts on several colleagues' machines, and personal accounts on America Online, the Well, and Echo. Thus, the number of users per host is not really as important as the number of hosts per user. Such information can be obtained only from a direct user survey.

Contrary to discussion on mailing lists, surveying the size of the Net will be difficult, complex, and costly. A national – and ultimately global – sample tracking survey is in order. Perhaps the most difficult factor in such a

survey is defining "usage." The survey must be based upon a theoretical model of Internet usage, such as models used in the adoption of new categories of products and services. Individuals in different stages of the adoption process must be measured, so that the survey can be used to predict and verify movement through these categories over time – today's e-mail newbie is tomorrow's Web surfer.

While the survey can be performed over the telephone, certain categories of users – for example university students and corporate users – will require special attention. The survey design should be a complex cluster sample requiring special estimation of sample error – not a task to be undertaken by casual researchers.

The survey must go well beyond a mere head count of Internet users. In addition to standard items on amount of use and demographics, the study should provide answers to *why* people use the Internet and what they think about its commercialization.

A Recommendation

We propose that an Internet Users Measurement Advisory Panel be formed to develop a set of protocols for the rigorous measurement of Internet users and their characteristics, including the larger group of individuals with any kind of network access. The focus should be on defining and estimating segments of usage based on customer need.

We further recommend that the panel:

- Be composed of experts in measurement and psychometrics, survey research methodology, marketing and consumer research, computer-mediated communications, public policy, and computer science.
- Produce Internet-accessible protocols for peer and public review, comment, and criticism.
- Be funded by a consortium of diverse interests including government and private industry.
- Direct the execution of surveys based on the protocols on a regular (at a minimum, annual) basis.

We do not, however, advocate a set of proprietary surveys driven by the concerns of one or a few large firms. Privatizing this information flies in the face of the anarchic, yet democratic roots of the Net and may be the surest path to a monolithic, mass-market vision of a commercialized, yet sadly "de-evolved" Internet.

It is time to act. The Internet has changed dramatically in size, character, and economic importance, but may not evolve further without careful measurement of its users. Until then, the lack of accurate and credible information about Internet users is likely to hinder the continued health and positive development of electronic commerce.

Donna L. Hoffman (hoffman@colette.ogsm.vanderbilt.edu) and Thomas P. Novak (novak@moe.ogsm.vanderbilt.edu) are associate professors at Vanderbilt University's Owen Graduate School of Management, where they research the marketing implications of commercializing the Internet.

The problem with data is that it's dead. We should bring it back to life by thinking through all the relationships it participates in.

Despite all the hype about faster and better and cheaper and friendlier, it's amazing how little the foundations of computing have changed. From the 1940s to today, the raw material of computation has been something called "data." Data is made of bits; it's the stuff that's read in as "input," stored in computer memories, and named with variables in programming languages. But data isn't just numbers – it's also a way of thinking about the relationship between the abstract territory inside computers and the concrete territory outside them. Data has meaning – it represents the world. It can represent things inside computers, of course, but also represents things outside them: your age, the price of eggs, the number of cases of AIDS in New York, the predicted temperature in Brazil 10 years

Living Data

By Phil Agre

from now, how likely you are to buy a cubic zirconium ring. The basic function of a computer is to crunch this data: it grabs data from somewhere in its memory, shuffles and recombines the bits in some meaningful way, and stuffs the results somewhere else. It does this several million times a second, of course, but that's what it does.

We're so accustomed to data that hardly anyone questions it.

But data is obsolete. It's an archaic leftover that causes boundless mayhem and will inexorably be replaced – either quickly, if everyone wakes up now, or slowly and painfully, if we continue to think of the difficulties caused by data in shallow and fragmented ways.

Data is missing at least five things, all of which become both necessary and possible in a world of globally distributed computing:

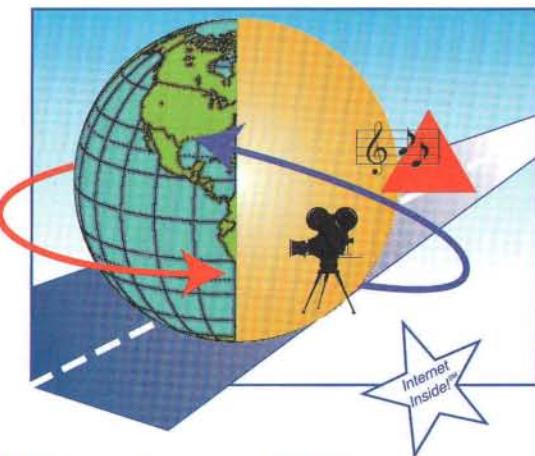
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- Ownership. Where did this data come from? What are we allowed to do with it? To speak of "owning" data glosses a variety of things, from trade secrets to research ethics to contractual constraints on its use. So long as the data stays within a single program on a single system, these rules can be embedded implicitly in the software. But as data starts migrating to other machines and getting merged with other data, the rules need to migrate as well. And as new uses arise, the rules will have to be renegotiated. Your software agent needs to get my software agent's permission – through a firewall of anonymity enforced by encryption if necessary – before you mess around with my data.
- Error bars. How reliable is this data? Real scientists put error bars on their numbers so they can tell whether they've gotten an answer or just a number. For example, 50 ± 3 means it's probably between 47 and 53, but 50 ± 83 means it's probably between -33 and 133. Big difference. When you add, subtract, multiply, or divide numbers you need to calculate the error bars for the result. Two numbers with big potential errors add up to a result with an even bigger potential error. But few computers make it easy to maintain this information, and few programmers ever bother. As a result, nobody knows whether most of the numbers that come out of computers are meaningful or not.
- Sensitivity. This is similar to error bars. If someone makes a model of expenses under some health care proposal, the original input data will include a bunch of numbers that someone had to measure or estimate. How fast does the final answer change as you start modifying the input by plausible amounts? Answering that question is what spreadsheets are for, but only if someone checks each possibility by hand and bothers to save the answer. It should happen automatically.
- Dependency. What data was used to compute this data? If something is screwy, can we trace the calculation back and figure out which input it depends on? And what data was this data used to compute? If we discover an error in our data, do we have a way of informing everyone who believed us before? As we all know, errors propagate a lot faster than they can be repaired. This would change if the data could stay connected both upstream and downstream.
- Semantics. Now that computers are going on networks, thousands of databases are being connected to one another. The problem is that most of those databases have arisen independently of one another – in different organizations, different departments, and different professions. As a result, it's very common for two databases to contain columns of data named by the same word – such as "price" or "name" or "approved" – even though that word means subtly different things to the people who created the databases. We probably can't explain the complete semantics of our words to our databases, but at least we can record simple things like units of measurement (is it "gallons" or "gallons per sec-

ond"?), so that the numbers themselves can check whether it makes sense to compare them.

The problem with data is that it's dead. We should bring it to life by thinking through all its relationships – both with other data and with the circumstances in the world that it's supposed to represent. One proposal is to make every last hunk of computerized data its own intelligent software agent, storing information about itself and exchanging a stream of messages with all other relevant data. Having done that, we'd then have to redefine the other basic concepts of computing so that those millions of operations per second compute something meaningful – not just something that looks good. Sounds inefficient, doesn't it? But basic processor speeds will keep on accelerating, and the computers of the world will keep on getting connected through networks. Let's spend some of that exponential growth on the production of useful answers and the prevention of computerized hassles.

Why aren't these things happening? They are, in small ways. But not in big ones. Unfortunately, a lot of the major data movers benefit from not knowing how meaningful their numbers are. A credit bureau just reports the numbers it got from somewhere else; if it were easy to find out how those numbers were collected, then demands for quality control would increase. A whole industry produces high-tech simulations for lobbyists and talk-show hosts to quote, and it wouldn't be good for business if everyone could find out how sensitive those numbers were to long lists of hidden assumptions. The people who sell mailing lists don't have to weed out so many marginal prospects because it's hard to tell exactly where the names and addresses came from or how current they are. In general, managers everywhere mostly use computers to justify the actions they've already decided on, and dead data can't call them on their games.

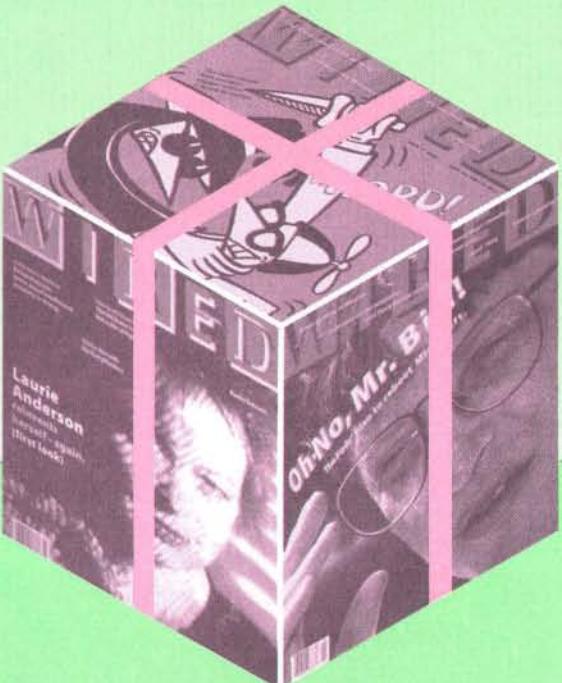
Another problem is that the old way of doing things is embedded in heavily entrenched standards. The Pentium chip doesn't help you build living data. Neither does any widely used programming language. Of course, you can build your own software abstractions on top of these things, effectively simulating living data. But that's no help until standards are established for all of the automatic interactions that living data requires. The introduction of intelligent agent languages like Telescript, though, provides an opening – a chance to do it right. Timing here is everything. If you want computers to be built right – not just fast and cool – then go visit some standard-setting meetings. Find corners of the technological world that are moving from one generation of computing to the next. And insist that "efficiency" be measured in terms of people, not in terms of machines.

Phil Agre (pagre@ucsd.edu) teaches in the Department of Communication at the University of California, San Diego.

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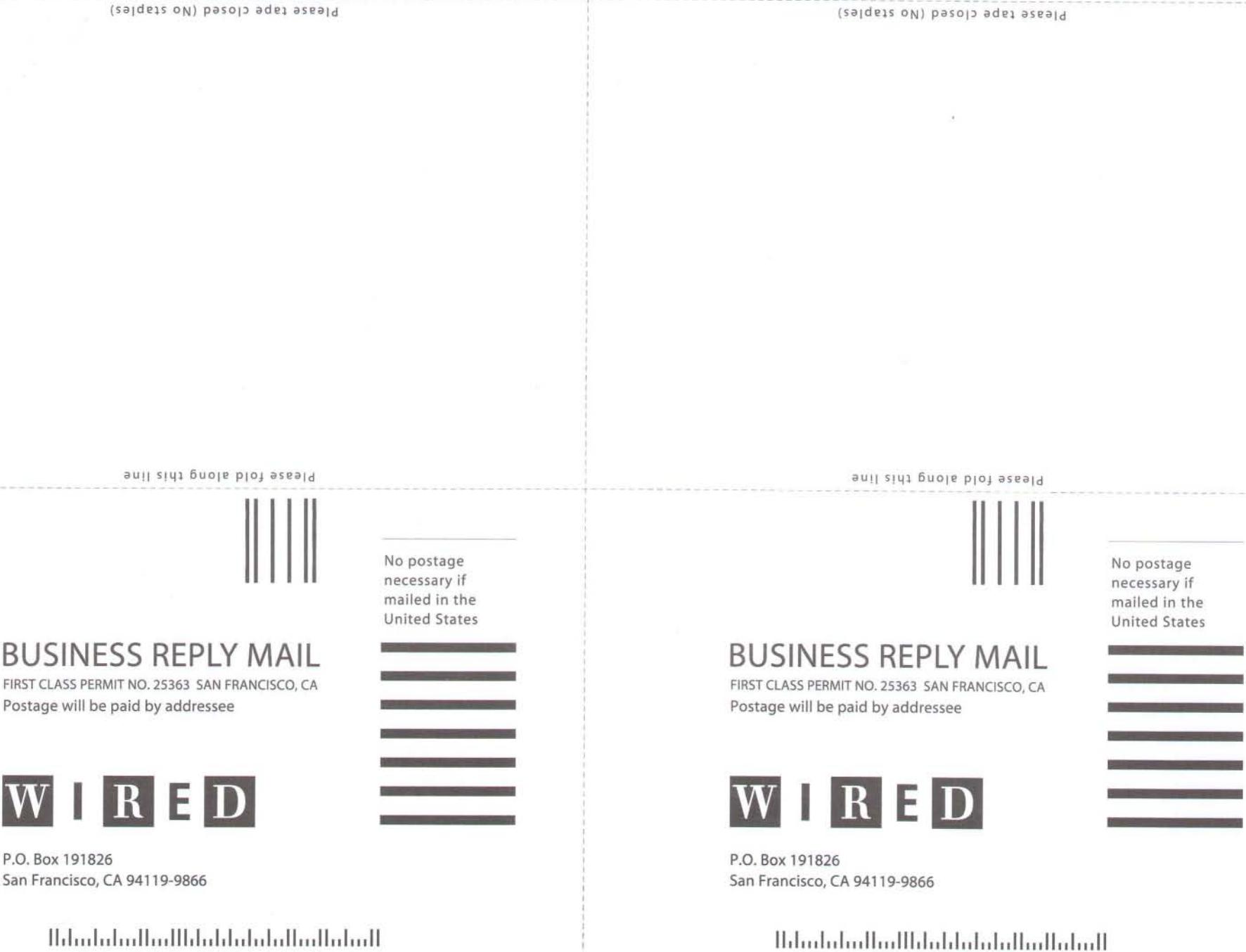
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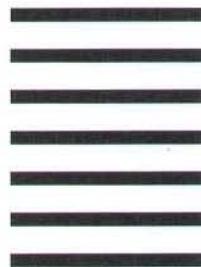
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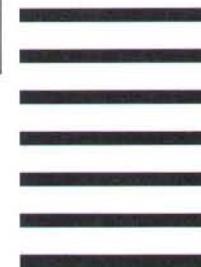
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CONSPIRACY OF HERETICS

By Joel Garreau

The Global Business Network was founded in 1988 as a think tank to shape the future of the world.

It's succeeding.



Peter Schwartz



Napier Collyns

WHAT IF?

In 1991, GBN devised three broad scenarios for the global economy in the next 25 years. Each of these possible futures – Global Incoherence, Market World, and New Empires – depicts a planetary society that depends on certain "driving forces" dominating in one future while receding in another. The three visions are rendered as digital montages by BRAINS.

GLOBAL INCOHERENCE ▶

The world shifts into a free-for-all. Ethnic pride and tribalism explode. Nations impose selfish trading tariffs. Japan crashes. Debt and white-collar depression spread worldwide. Corporations consolidate to survive. Rinky-dink warlords become entrenched, and paramilitary organizations exert regional power. Nuclear blackmail surfaces. There is no seamless global superstructure and no global police force. Black markets and very organized transnational crime flourish. Diversity rages.



Stewart Brand

ЗИЛДЕШИТ
СИТЕКИД
ИГКУФ

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On April 21, 1994, between 7 p.m. and 9 p.m. – the Twilight Zone, you might call it – I rendezvoused with a blend of fantasy and reality in which, you'll be happy to know, the future of the planet was successfully resolved.

The encounter occurred aboard the presidential yacht USS Potomac, the same steel-hulled craft that, half a century ago, carried Roosevelt to his meeting with Churchill wherein they secretly plotted World War II. It cruised on the San Francisco Bay as helicopters hovered above, dropping smoke flares to mark a jumper from the Golden Gate Bridge.

The twilight was a glorious gold, fading to a cool blue-gray.

Reality started turning to smoke, however, as I listened to the people on board bartering the globe. Those identifying themselves as Middle Easterners and Africans – controlling the world's gold, oil, diamonds, and rare earths – quickly made deals that they said raised US\$500 billion. They needed it badly, they felt, to protect themselves from a Russian named Boris.

Over by the bar, a lean, shifty-looking man actually went by that name. The Europeans said they feared such a man might be the 21st century's Adolf Hitler. This led to sophisticated discussions about America's war machine. How fortuitous, everyone agreed, that it still exists. Several people on the boat speculated as to the circumstances under which it might be leased.

Those who said they embodied the interests of Asia largely ignored those who represented North America. They were too preoccupied with their bucking and surging economies. The Americans were mildly surprised. But since they were focused utterly inward, intent only on transforming their newly lean multinational companies into mean global forces, they shrugged it off.

Sideshows abounded. The fool Brazilians cutting down the planet's oxygen production, it was agreed, must be dealt with. So the wasteland of the Sahara would simply have to be forested. Africa's Rwanda-like chaos-wars might even be damped by such a project, some felt.

There were surprises. Microsoft was quietly discussed as far more effective a world shaper than the International Monetary Fund. The Latins were startled by how much better the North Americans were at presenting a future for Brazil, Chile, and Argentina than were the South Americans themselves.

I, meanwhile, was having a marvelous time wandering about in the guise of a world-weary diplomatic sleazeball representing "international institutions" like the United Nations and the World Bank. Almost involuntarily dropping into a British accent, I sidled up to a chap who supposedly was a neighbor of North Korea and said, archly, "Say,

Joel Garreau, author of The Nine Nations of North America and Edge City: Life on the New Frontier, is a staff writer at The Washington Post and the troll of a small forest in the foothills of Virginia's Blue Ridge.

old man, have you any security problems you find sticky? Pity. Perhaps you might give us a ring."

In one dimension, this was all a game. A trivial little game really, conducted by an outfit that at one level is only a vanishingly tiny \$4.5 million international consulting company – Global Business Network.

But that is only one layer of reality. To this day, I ponder how history may have shifted during that "game" that I was a part of because I, too, am a member of the Global Business Network. "Membership" is a tricky word at GBN; there is no initiation ritual. One simply gets more and more tangled in its swirling mists. I was first asked to join a discussion on the network's private BBS. Then I started receiving books that members thought I might find interesting. Then I got invited to gatherings at fascinating places, from Aspen to Amsterdam. Finally, I was asked to help GBN project the future regarding subjects about which I had expertise. By then, the network seemed natural.

The GBN members who rehearsed the future on that boat hailed from the Singapore Ministry of Defense, the Australian department of taxation, the Mexican Stock Exchange, the London Stock Exchange, Volvo, Fiat, Petroleos de Venezuela, Allstate, DuPont, ARCO, Saatchi & Saatchi, the American Express Bank in London, and the Executive Council of the Club of Rome. And that scarcely begins to define the group. For spice, there were the likes of Jon McIntire, former manager of the Grateful Dead, and theoretical neurophysiologist William Calvin.

Nor does that game and list of players delimit the group's ambitions. The agenda for the next day was modestly labeled "The Restructuring of the World Economy."

Toward the end of the boat trip, Jay Ogilvy, a co-founder of Global Business Network, reclined in a rattan deck chair of the style favored by those who, back in the '40s, created our modern world.

"I like this," he said,

M A R K E T W O R L D ▶

The world converges into a single market.

Trading barriers drop, and international trade skyrockets – the goods in shops become universal. Edge cities overtake capital cities as cultural centers. National governments devolve; organizations such as the UN, the World Bank, and McDonald's shape regional politics. The Net becomes ubiquitous. Electronic money replaces cash. The gulf between the "knows" and the "know nots" widens. Businesses fund a revolution in education. Urban problems continue to worsen.

Second World countries become the main event.

sipping his sauvignon blanc as he gazed at the bosom-like hills of Marin. "I like it a lot."

He was referring to the pleasures of lording like a



GREAT
WALL
MALL

夏國輝

ADDITIONAL
PARKING

中國航天

國美大國

BANK

INTERNET

MODA

到處
青青
山雨
而來

potentate over a rented boat.

But once again, not entirely.

Ogilvy is one of five white men of a certain age who, in 1988, created a company/think tank/men's club whose explicit purpose is to shape the future of the world.

It is succeeding.

The Joint Chiefs of Staff, for example, hired Global Business Network to help figure out what the nature of military threats to the United States might be for the next 30 years. (The most challenging possibility: what would they do should they face decades of peace?)

How about the LA riots and the collapse of the California economy? GBN helped Pacific Gas and Electric Company anticipate the consequences of both, causing the utility company to put major and early emphasis on convincing industry not to leave Northern California.

Back when the Japanese stock market was flying and Japanese car companies seemed invulnerable, GBN helped Nissan North America Inc. imagine how it would stave off bankruptcy and where it might move its factories if, as actually came to pass this year, the unthinkable happened and the yen dropped below 100 to the dollar.

Back when AT&T thought of itself as a collection of telephone cables, GBN helped the company imagine the modern world in which mobile communication defines the future, and entertainment drives the system.

What happens when broadcast television collapses and the underpinnings of entire industries disappear? That was of interest to Leo Burnett Company, one of the world's major advertising agencies; Universal, one of the world's biggest producers of broadcast programming; and ABC, the television network – all clients of GBN who listen to its advice.

How will we handle the crisis when, as seems plausible later this decade, half of the US nuclear-power-generating capacity becomes too expensive to operate? GBN has thought about it.

What happens if computer shopping kills off every mall? A retailer with gross annual sales larger than the GNP of some European countries keenly wanted to know. They went to GBN for a hint.

Suppose the Asian economic miracle fails, brought down by regional wars and a belligerent China, and the whole territory begins to look like El Salvador in the '80s?

GBN has profited from untangling concepts like "loyalty," "altruism," "community," "honesty," "individualism," "justice," and "fun" for Dentsu Inc., the Japanese advertising agency that is the largest in the world.

GBN is currently indirectly helping the White House plot a course for sustaining the planet should there come a world ecology crisis – a sudden shift in the Gulf Stream brought on by global warming, for example, coupled with the aforementioned nuclear crisis.

In the world of consulting, this is beyond all imagining. "Given GBN's size, it's an absolute miracle that I've even heard of it, much less that I have an image of

it" as a world leader in futurism, said Melvyn Menezes, manager at Gemini Consulting, the \$516 million Morristown, New Jersey-based firm which has offices around the world.

But then again, at only one plane of truth is GBN a consulting company. In its other, more mysterious guises, GBN pops up in the darnedest places.

When a very informal group of GBNers, as they call themselves, became interested in the future of money, the Federal Reserve Bank of San Francisco was so impressed with the intellectual and financial power and connections of those who asked for the visit, it rolled out the chief operating officer. As he presided, woodenly, a rather more fluid woman staffer described her plans to have the Fed electronically dematerialize the world's checks. An encryption hacker with a dastardly imagination brought along by the GBNers grilled her about the security of these trillions. As an aside, she discussed the resiliency of \$100 greenbacks as the currency of choice in some 30 countries.

The day before, when Genentech Inc., one of the world's leading biotech companies, had discovered GBN was coming, it was sufficiently awed that it rolled out its director of bio-organic chemistry, director of pharmaceutical R&D, director of business development, and several of its hottest, young, jeans-clad scientists. The primary thing the GBNers learned from this encounter was that when bioengineers create new forms of life, they rarely, if ever, discuss the ethics and societal implications of what they're doing. "Just wait till this technology moves off-shore," said GBN co-founder, Stewart Brand. "The developing countries' corporate motto is gonna be" – he smirked and waved his hand – "Ahhhhh, Just Do It."

A private computer bulletin board through which members stay in touch reveals why "Global" is this brotherhood's first name. Members chew to boredom the technical vexations of reaching the Internet from the remote portions

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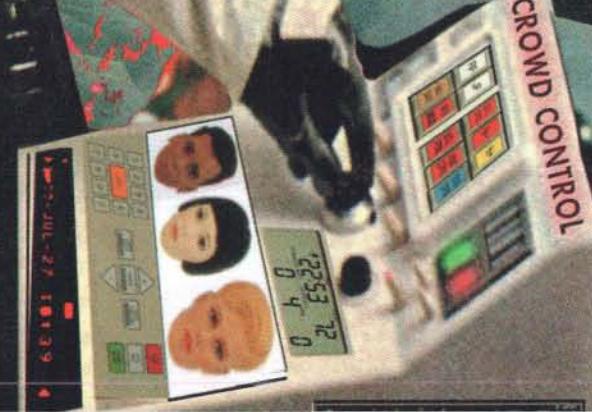
Authoritarian structures reemerge. Governments become businesses.

New environmental and green technologies are mandated over shared borders. The infrastructure of developing countries leapfrogs, becoming state-of-the-art through massive infusions of centralized capital.

Europe rebounds. Social engineering returns.

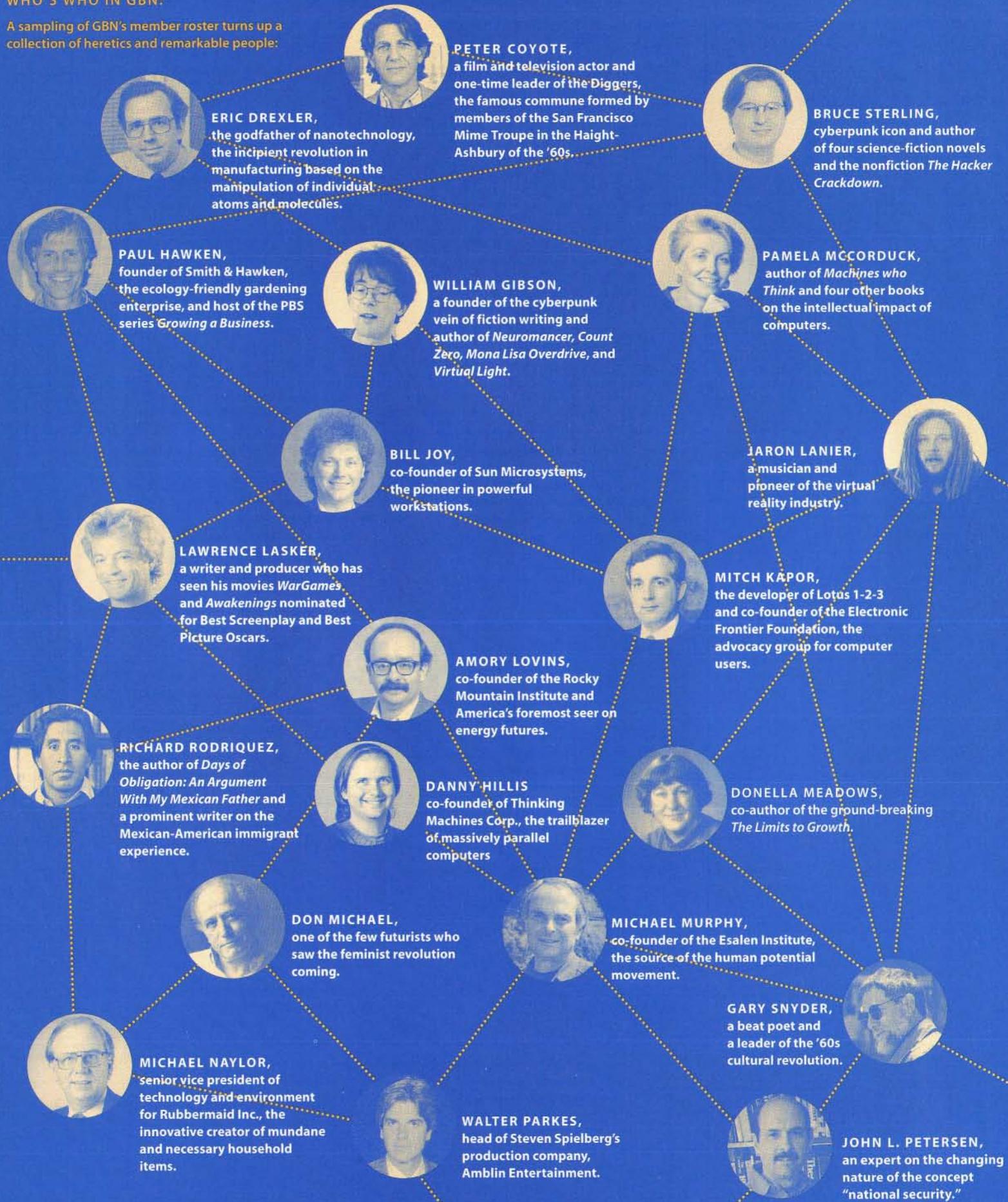
of
extinct
empires. It's the kind of complaint that is really a subtle form of one-upmanship: it announces one's arrival in, say, Tashkent, with an assignment important enough to require a laptop.

Indeed, GBN has influenced your life. The magazine



WHO'S WHO IN GBN:

A sampling of GBN's member roster turns up a collection of heretics and remarkable people:



you're holding in your hands was co-founded by Executive Editor Kevin Kelly. Kelly is a member of the GBN cabal. To the cognoscenti, the GBN inspiration has been obvious – perhaps essential – in every issue of *Wired*.

The origins of Global Business Network, oddly enough, lie in the oil business. The reasons for its existence can be traced back to the '60s, 20 years before GBN was founded.

The golden age of American stability – the '50s – was breaking up on a number of sharp rocks: the Baby Boom, contraception, wars of national liberation, drugs, new technology, the rise of the Pacific Rim, and rock and roll.

It was abundantly clear to those who wished to think about it – markedly few of whom were in the Fortune 500 – that not only was change and upheaval upon them, but it was not going to stop. In fact, even change was changing – becoming unprecedented in magnitude and ever more impossible to prophesy.

This was not so obvious a proposition as one might think. The strategic planning of the time assumed one could project existing realities out in a more or less straight line and achieve satisfactory results. If General Motors was the world's preeminent automobile manufacturer, it would continue to be so. If IBM based its business on mainframes, that would be OK forever. Rapid discontinuous change? Why plan for that? Hadn't happened much in 25 years.

But one year, 1973, changed everything. The quadrupling of energy prices redrew the world's power map and fundamentally rocked the industrial economies. Only one organization, Royal Dutch/Shell's Group Planning, anticipated the energy crisis. Don't take my word for this. The evidence is presented in Daniel Yergin's *The Prize: The Epic Quest for Oil, Money, and Power*, the bestselling 1992 Pulitzer winner that gives Shell's Group Planning the credit. (Yergin, too, is a member of GBN. Watch the wiring diagrams here.) This fraternity is not called the Network for nothing.)

It is virtually impossible to overestimate the importance of foreseeing that radical discontinuous change in the world of oil prices back in the '70s. The planners at Shell were not only pioneering a new way of thinking about the future; they had so much confidence in it as to go to comrades-in-arms and tell them to end their businesses. If the consumption of oil was going to crash because of soaring prices, the economic survival of Shell depended, for example, on stopping the building of supertankers immediately. This was thought by most to be insane. Everyone "knew" the oil industry to be invulnerable. Friendships terminated. Anguish ensued.

But Shell Group Planning, whose alumni would eventually found GBN, had it absolutely right: as a result, in 1990, Shell won its 70-year war with Exxon, passing it to become the largest oil company in the world. Group Planning was also right in predicting the second price shock in 1979, with its attendant upheavals, and the ultimate price collapse of the '80s

that led to, for example, the economic depressions of Houston and Denver.

For an encore, Group Planning also anticipated the rise of Gorbachev and the collapse of the Soviet Union.

Thus, it is little surprise that in 1988, a year when Pentagon planners were saying that for the next 50 years, without question, the major threat facing the United States would be the Soviet Union, the very first sentence of the first scenario book that the newly formed Global Business Network wrote, was "The Cold War is over."

Global Business Network was founded by Shell alumni such as Peter Schwartz and Napier Collings to be a sort of Group Planning not just for one company, but for the world. Today, even the Pentagon is impressed, for GBN's kind of thinking is becoming recognized as the cutting edge of "futurism."

GBN's renown is largely due to the work of a Frenchman, Pierre Wack (pronounced "Vack"), who as head of "business environment" research for Shell Group Planning in the '70s, helped pioneer an utterly improbable idea.

Wack burned incense in his office and spoke in riddles and parables. His speeches were mesmerizing, like those of a stage magician. When he retired in 1981, it was to a medieval château in the south of France. He looks like Yoda.

Wack claimed that if the rules of the world were constantly changing, it was hopeless to get the "right" forecast. Hiring more or better forecasters to project existing realities in a straight line was pointless. The stakes were too high, the changes too widespread. Just look at the unexpected upheavals of feminism, to pick one example. Who would have guessed back in 1970 that women entering the workforce in America would help cause the number of cars on the road to double, and all-day traffic jams to become common?

The only stability, he argued, was in accepting uncertainty. Organizations would have to be systematically open to heresy.

Wack thus developed "scenario planning."

Scenario planning is gracefully described in *The Art of the Long View*, by the man who in the '80s held Wack's old job at Shell – GBN co-founder Schwartz. Scenario planning is the methodical thinking of the unthinkable. It searches for wisdom in unusual places. It assumes that there will never be enough information on which to base a decision, if that decision requires certainty about the future. Therefore, it is important to prepare a wide range of possible decisions based on an entire range of possible futures. Never being wrong about the future is better than occasionally being exactly right.

In this view, the best way to deal with the possibility of falling over a cliff is to help people figure out in advance how tall and steep the cliff is. Also to calculate how many different kinds of cliffs there are. And how to recognize when a cliff is coming, and which kind it is.

This is not trivial. Not only must one know what possible futures exist, but one must know how to recognize into which previously anticipated future one is

entering. For, as Cicero wrote, "It was ordained at the beginning of the world that certain signs should prefigure certain events."

One astonishing example of scenario planning in action occurred in the early '90s. At the invitation of a multiracial group of South Africans, Adam Kahane, a Global Business Network member and alumnus of Shell Group Planning, shouldered no less a task than seeing whether scenario planning could help turn that pariah nation into a multiracial democracy.

The Mont Fleur scenarios – as they became known, after the small town near Stellenbosch, South Africa, where, in 1991, they were first devised – were the first in the world to attempt the turnaround of an entire country.

These Mont Fleur tales tried to describe nothing less than the ways the world might be tomorrow. The amazing thing about them is that their narrative power was so compelling that they caused everyone from the radical African National Congress to the crypto-fascist National Party to agree objectively that they were accurate descriptions of the possible future realities.

There were four main futures for South Africa. Everybody, after intensive discussion, agreed that the following were logical and plausible:

► "The Ostrich Scenario." If the white power structure just stuck its head in the sand – did not face the world economic and political isolation, did not deal with internal black unrest except by repression, and did not conduct negotiations with the majority – the result would be massive internal resistance, international condemnation, violence, flight of capital and skills, and economic deterioration. Then things would get really ugly.

► "The Lame Duck Scenario." If negotiations did occur, but the result was a grudging transition to the new, in tiny steps and dragged out indefinitely, the country would be marked by indecision, lack of confidence, lowest-common-denominator waffling, uncertainty, and a resultant lack of outside capital infusions to either turn the economy around or solve social problems. Nobody would be truly satisfied.

► "The Icarus Scenario" (fly now, crash later). Suppose negotiations occurred, and the transition to the new was rapid and decisive, but the result was a populist government that went on a huge spending spree to try to cure all the problems of generations overnight. As has happened so often in Latin America, deficit spending would cause a brief boom, but ultimately the country would become an economic basket case, and the poor as well as the wealthy would end up worse than before.

► "The Flight of the Flamingos Scenario." Flamingos take off slowly, but fly high and together. In this scenario, negotiations and a quick transition lead to effective, sustainable, clean, inclusive government, generating the economic growth that allows social problems to be addressed. Everyone lives happily ever after.

The amazing thing about these 153 ►

The dancing cars in this summer's Shell Oil ads, the flying dagger in *The Shadow*, and the effects for *The Last Action Hero* are the work of R/GA Digital Studios, the hand behind 2,000 commercials and 300 feature films. R/GA's director of computer animation, Joe Francis, designed the image at right to represent the essential tools of the computer animators' craft – hundreds of tiny coffee cups, reels of film, and magazines.

Started by Bob Greenberg and his brother Richard in 1977 with US\$15,000, the original company, R/Greenberg Associates, made a name for itself "flying" the opening titles for *Superman*. When the film premiered in 1979, audiences clapped after the first 20 seconds. Today, R/GA has 175 employees and grosses \$35 million.

Restructured in 1992 to resemble a flexible network of nodes, R/GA is made up of seven independent companies. Each specializes in one area of visual imagery, from print to interactive entertainment. If a project uses more than one medium, the companies turn to each other for help. The result: a one-stop visual-effects house.

Also in 1992, Bob Greenberg opened RGA/LA to compete with West Coast firms like Industrial Light & Magic. Soon after, R/GA mastered the difficult task of placing a young Clint Eastwood next to President Kennedy for Columbia's *In the Line of Fire*. But it wasn't the first time Greenberg brought the dead and the living together on celluloid – he'd done it before in Woody Allen's *Zelig* and in Diet Coke ads pairing Paula Abdul and Cary Grant.

Bringing the dead to life is part of R/GA's next big creative push in advertising. Interactive advertising, Greenberg thinks, can benefit from taking celebrity endorsement to the next step, where celebrities communicate with customers on an individual basis, creating a personal dialog. Greenberg is negotiating with the estates of famous actors for the rights to reanimate them as high-cachet virtual hosts. The first interactive ad, for Chrysler, is being released at Time Warner's interactive test site in Orlando, Florida. Another, for the US Postal Service (no kidding), is scheduled to follow. – David Bennahum

David Bennahum (davidsol@panix.com) is a contributor to *The Economist* and *Lingua Franca*. His second book, *k.d. lang*, is out now.



ROCKET

The first digital supergroup is about to serve up addictive thumb candy — or become



SCIENCE

the next smoking crater in the videogame biz. By Burr Snider.

By Burr Snider,

Photographs by William Mercer McLead.



Think thumb candy. In the carnivorous world of videogames, a lot of smart people spend a lot of time trying to figure out how to appeal to a market consisting mainly of a lot of fidgety, fickle adolescent boys. Game designers talk of the connection between testosterone level and attention span; they talk of the phallic nature of the joystick; they talk of the classic hero's quest à la Joseph Campbell, of the primal appeal of mythological archetypes and Jungian mazes; they talk of gender-specific hunting-gathering drives and the etiology of the basic boyish glee derived from watching limbs being dismembered and gore being splattered.

What everybody is looking for, of course, is that elusive, addictive element of "playability" that glues a kid's hand to the controller, engages his motor functions pleasurable, and glazes his eyes as he sits for hours waging furious battle with enemy forces and dodging insidious traps waiting to do him in on the little screen.

Thumb candy.

It's what generates buzz – and buzz, it goes without saying, is what sends 'em dashing down to the mall, allowance hot in the pocket. It's the difference between shelf-clearing megahits like, say, *Mortal Kombat*, *Myst*, and *7th Guest*, and any one of the hundreds of expensive failures littering the video landscape.

The only trouble is that nobody can accurately formulate sure-fire game hits on a consistent basis. Trends change, kids' tastes evolve, the moon enters a new phase. One day it's goofy Italian plumbers, the next it's gouts of spouting arterial blood. This is a big-time crapshoot

A lot of smart money is betting that this audacious upstart might just hold the secret recipe for some of the tastiest thumb candy to come.

with one constant: while per-unit profit margins are huge, the cost of producing games has soared astronomically, sometimes exceeding US\$1 million a title.

Nonetheless, the interactive home-entertainment market currently generates around \$6 billion annually, more than the box office earnings of all the motion picture studios combined. And with sales of PC CD-ROM hardware expected to double by the end of the year, the potential just keeps on ballooning. As the market matures, game theorists have devised a new strategy: grafting Silicon Valley engineering and gameplay with Hollywood production and special effects. The results, they hope, are games increasingly more theatrical in presentation and appearance – movies, in effect, to control and move around in.

But so far, no one's really pulled it off. It's a wide open race among the big-name, established contenders – Sega, Nintendo, LucasArts, 3DO, Accolade, Acclaim Entertainment, Electronic Arts, Spectrum HoloByte – to see who'll take the lead in this new generation of games.

But there's an unknown on the track, too – a brash little envelope-pushing San Francisco Bay area-based outfit sporting the whimsical name of Rocket Science Games Inc. With lavish financing, a radical new "Sili-wood" production plan, and a star-studded roster of designers, coders, and producers, Rocket Science is already generating the loudest buzz in videogames, even though its first titles (for Sega CD as well as Mac and PC CD-ROM) won't hit the shelves until the '94 Christmas season – right around the time you read this. All the hype surrounding Rocket Science may be glaringly premature, of course, since the ultimate jury is composed of those hordes of twitchy-handed

teenagers, but a lot of very smart money is betting that this audacious upstart with the glittering pedigree might just hold the secret recipe for some of the tastiest thumb candy to come.



We've (Never) Done This Before

Sitting at a conference table in the industrial-gray offices of Rocket Science in Palo Alto, California, CEO Steve Blank is somehow simultaneously anxious and sanguine. A smooth Valley vet who's been through the start-up drill enough times to be realistic about the odds involved, Blank nonetheless exudes the confidence of a man who firmly believes he's riding a winner. By his own count, Blank's start-up record is pretty decent – three ringing successes against one "smoking crater." Before co-founding Rocket Science he was vice president of marketing at SuperMac Technology, the largest producer of hardware peripherals for the Macintosh, and before that he helped start Ardent Computer (the crater) and MIPS Computer Systems. He was also marketing vice president at Convergent Technologies. And, oh, by the way, he did a little spook work way back when with ESL, the hush-hush government contractor started by Bill Perry, Clinton's secretary of defense. (Blank isn't telling exactly what *that* was all about.)

But it's Rocket Science, he wants to make clear, that's got his entrepreneurial juices flowing most copiously. "All I can tell you," Blank says affably, "is that Rocket Science looks good and it feels good, even though when someone asks me to describe it, I'm somewhat at a loss. It's not quite Hollywood, and it's not quite Industrial Light & Magic, but if you can imagine ILM and Disney combined, you can probably get a feel for it."

In Valleyspeak, Blank explains, Rocket Science is what is known as a "convergence play," and what makes the company different, he believes, is its strategy of spending a ton of up-front money to hire a high-profile team of hit-game creators, software engineering wizards, special-effects magicians, and top Hollywood writers and production designers – in order to revolutionize the way games are made. The fledgling concern has been equated with Cream, the Eric Clapton-led Brit supergroup of the late '60s, and Blank doesn't shrink from the comparison. But even with Hollywood design legend Ron Cobb (think *Alien*, *Terminator*, *The Last Starfighter*) and veteran screenwriter Mike Backes (*Rising Sun*, *Congo*) in the lineup, Blank has assigned the center-stage role to Peter Barrett, a 26-year-old Australian whiz kid who is the prime force behind the company.

"The whole thing started with Peter, who was the undisputed superstar at SuperMac when I was there, responsible for probably 80 percent of the revenue-generating product," says Blank. "Long ago, Peter had the rather prescient observation that CD-ROM would be the next big games distribution medium, and that the technology would allow people to tell stories and execute games in a way that wasn't possible in a cartridge. When I heard Peter had some new ideas for developing games software and that he wanted to bring together this team of superstars to construct a new production methodology, I got very interested. And so did a lot of other people."

An understandable reaction. The charismatic Barrett had become something of a Valley legend in the late '80s when, barely out of his teens, he created the first acceleration hardware for Apple's QuickDraw graphics standard. Not long after, he invented Cinepak, a

Burr Snider has been a longtime features writer for the San Francisco Examiner and has written for such magazines as Esquire, Rolling Stone, Cosmopolitan, Oui, and Crawdaddy.

sophisticated image-compression scheme that enables game machines and personal computers to play real-time video from CD-ROM drives. Cinepak became the de facto standard and SuperMac made a licensing fortune on it; but all Barrett got out of it, according to Blank, was a small token sum and "a handshake." Ditto with VideoSpigot, another Barrett brainstorm. Nonetheless, his credentials as an authentic *wunderkind* were established, and when he came up with the idea for Rocket Science, Barrett had no trouble getting the right people to listen.

"I was doing some consulting for Merrill, Pickard, the venture capitalists, and in July of 1993 I took Peter to see Kathryn Gould there," says Blank. "Within about six minutes both she and I had the same reaction, which was that this was a great thing. Peter and I went home and worked up a presentation over that weekend; we pitched it to the whole group on Monday and got funded the same day. Peter had estimated that \$2 million would be enough to start, but, knowing him, I doubled it to four. The venture capitalists said eight, and the joke on all of us is that it's going to take \$20 million and we're not even a year old."

It's safe to say that few entertainment start-ups have generated as much advance hoopla as Rocket Science. When Barrett began assembling his dream team of performers, the games industry media chronicled every prominent hire. Insider speculation ran rampant as to whether such an all-star cast could mesh and click as a working unit. But as the company got down to the work of producing videogames, the word leaking out of Rocket Science's Palo Alto headquarters and its Berkeley design facility was consistently upbeat: Peter Barrett was onto something big, no less than the next significant step in the evolution of interactive-video production, and everybody involved was thrilled to be along for the ride.

Was it puffery, or was it real? Well, Barrett's game plan was impressive enough to convince some major entities in the home entertainment industry that Rocket Science was a viable proposition. In May 1994, barely 10 months after its formation, Sega Enterprises and the Bertelsmann Music Group jointly announced that they were investing \$12 million in the promising little enterprise, a move that not only signaled Rocket Science's entry into the big leagues of the games biz, but also opened up a powerful international network of distribution for its products.

"Sega rose to success with leading-edge technology and innovative marketing," said Mamoru Shigeta, Sega Enterprises's director of consumer software, at the time. "We see the same potential in Rocket Science."

So did the Times Mirror Corp., which only two months later weighed in with its own significant but undisclosed investment.



Addicted to His Work

It's a scorching Saturday in July, perfect San Francisco Peninsula beach weather, but, says Peter Barrett unapologetically, he'll be chained to his desk all weekend working to polish up Rocket Science's first two releases - *Loadstar: The Legend of Tully Bodine* and *Cadillacs and Dinosaurs: The Second Cataclysm* - for fall release. Is Barrett a classic Valley work-aholic? Put it this way: in his rare spare time it's said that he likes to write compression algorithms just for kicks. Nevertheless, he's happy to take a few moments to talk about his new toy and his passion for videogames. This is one game maker who has no trouble identifying with his market simply because he is that market. In fact, as Barrett would be happy to tell you, he is as addicted to thumb candy as any joystick jive-ass cruising the malls looking for



Loadstar
launches you
into a world
filled with flash
and danger.
When things get
wild, you have
only a split
second to
escape - and if
you don't dodge
in time, your
man will be fried
down to the
bone.

hot video action.

"I'm out there all the time playing in the arcades with the kids," Barrett laughs. "I know that the basic appeal of *Mortal Kombat* is the satisfaction that comes from tearing somebody's head off and seeing the blood shoot. But it's more than a spectacular act of decapitation, it's also loads of fun to play. The demographics at Rocket Science match the demographics of the people we're making games for, people like me who want smart, popular, well-conceived games. We're not making esoteric art noir videogames, but games that are like summer movie fare. It's the Jim Cameron *Terminator* sensibility – big, brash, exuberant stuff."

Barrett says his dream of creating a new kind of videogame originally sprang from his love of science fiction films like *2001* and *Star Wars* and *Alien*. Inspired by such escapist stuff, at some point he began to view games in a different light. "I started to think about an entirely new interactive experience using the elements of film and visual literacy and the craft of storytelling. I saw these guys at Sega using Cinepak and not taking advantage of its capabilities, producing bad graphics and dumb stories, and I knew there were people who could use it to full advantage – guys like Bruce Leak and the QuickTime team at Apple, and people at Industrial Light & Magic. Somehow I

Recall, and who was part of the team that made Meryl Streep's head spin so grotesquely in *Death Becomes Her*, was hired as art director, bringing the talented Oscar-nominee and matte artist Mark Sullivan (*Hook*, *The Rocketeer*) with him. Frank Cirocco, a well-known games illustrator who worked at Marvel Comics, and David Nakabayashi, a project director for 3DO who'd also worked on *Jurassic Park*, came aboard to round out the production team.

By this time, says Barrett, Rocket Science was like one big mutual admiration society. "Suddenly we had these all great talents who for years had been writing code or creating effects to implement somebody else's genius. Now we're letting them implement and express their own ideas, and we're spending a lot of money to make their visions real. Ron Cobb, for instance, can now tell his own story and not Jim Cameron's or Spielberg's or Lucas's. At Rocket Science, he's the man."

One of Barrett's prime selling points to the money people was his plan to formulate a new software architecture that would streamline games production. Called "Game Science," this technology is designed to solve the key problems inherent in making interactive CD-ROMs, such as the "click-and-wait" tendency players find so annoying. It's comprised of two critical tools, developed in-house, called "Game Composer" and "Game Compiler." The former is an application that creates a working blueprint of a game, allowing even naive designers to realize their ideas without ever seeing any code. Once a game is completed, Game Compiler can then manufacture and "repurpose" the game for various platforms, such as Sega CD or PC CD-ROM. Game Science not only saves considerable time and money, the Rocket Scientists claim, it also allows them to be "platform agnostic" in a business where no particular drive hardware dominates. And with these tools, Rocket Science computer architects say they've found a way to geometrically increase the options presented to players, thus enhancing their sense of being actors directing their own game movies.

"Everybody gives CDs a hard time for being so slow, but it's dumb software that squanders the resources of the CD," says Barrett. "It used to be in making games that you were almost scratching it out by hand, like using shadow puppets to tell your story, but Game Science allows you to build a digital description of a game that you can move around in. The Game Composer draws a diagram of the game that actually is the game, and lets you tinker when and where you want, to add a little bit of video from your library here or adjust the sound there. It's just like painting with Photoshop – you have the flexibility computers give you to adjust and experiment. And because you have a complete diagram of the game in digital form, you can have a battery of computers think about it for a long time and come up with the best way to put it on a CD to get the speed you want and lose the click-and-wait. A company like Sega would spend two to three times what we do to produce a similar title. Rather than spend a lot of money making a game from scratch, we put money up front on technology that we'll use again and again."

As for the games themselves, Barrett not only promises that they will be fast-paced adventures with compelling stories and high-end graphics, but also hopes that they'll reflect the sophistication of their young creators.

"We've tried to have everything in the games the consumer wants," Barrett claims, "and to be mindful, too. In both *Loadstar* and *Cadillacs and Dinosaurs*, for example, you can't shoot people, only inanimate objects like robots and rocks. It's the difference between a 'B' slasher flick and *Terminator 2*. Ron Cobb says we're restoring violence to its good name: we believe that there absolutely is a place for violence in games, just as there is in Shakespearean drama, but the ability to

"A company like Sega would spend two to three times what we do to produce a similar title," says Barrett, Rocket Science's 26-year-old whiz kid.

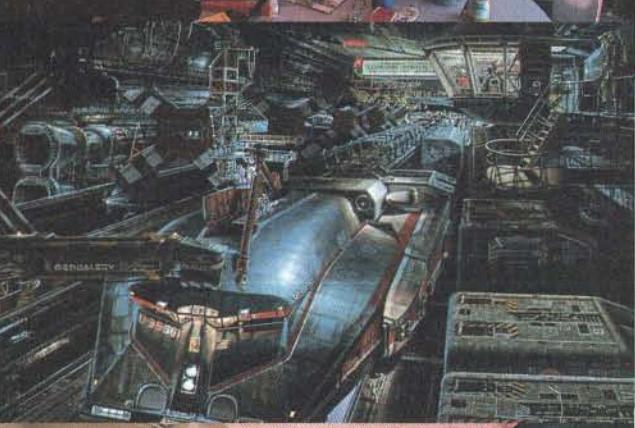
knew I had to get them together with guys like Brian Moriarty and David Fox, who had made some of my all-time favorite games, and see what would happen."

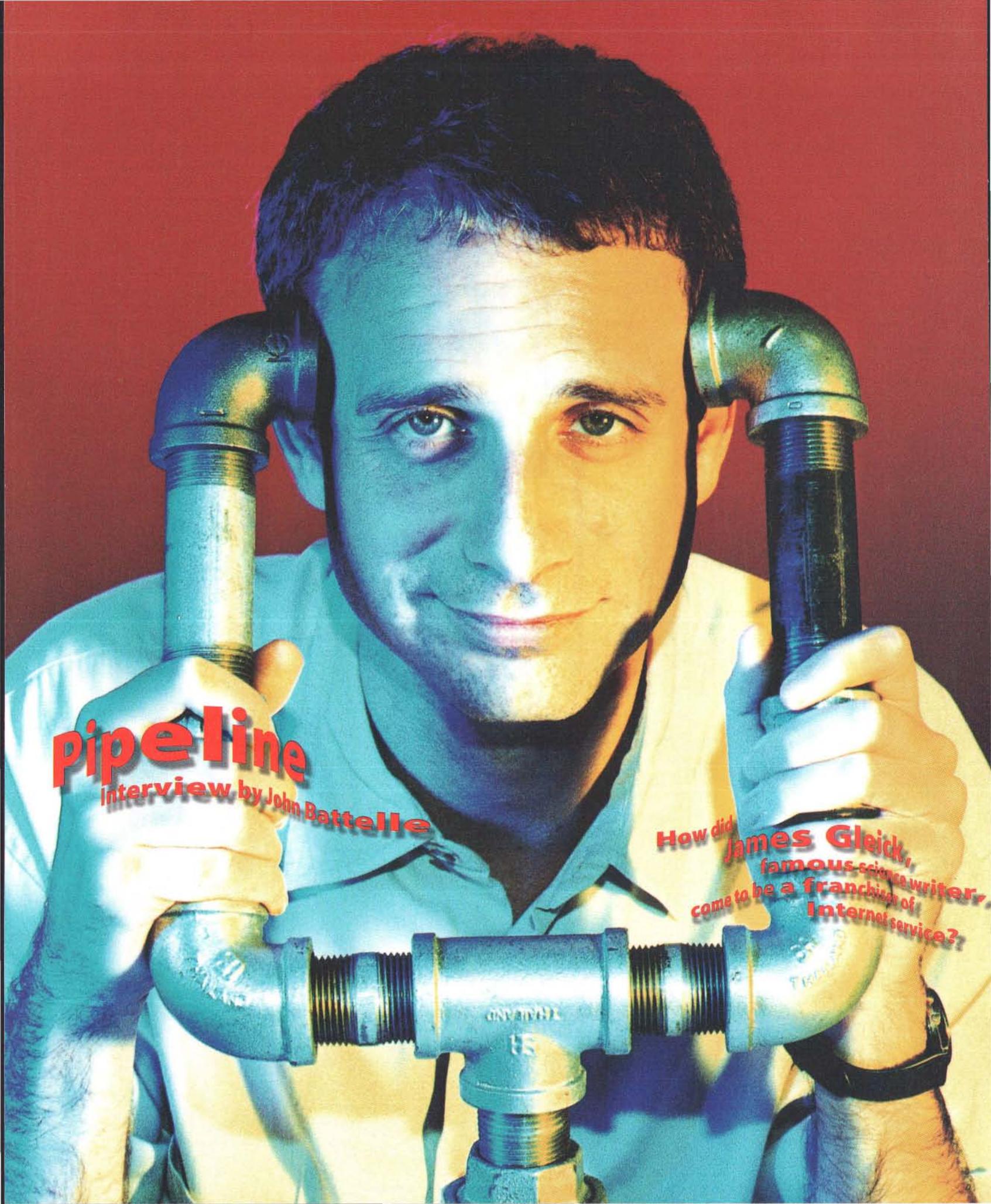
Once the idea for Rocket Science had gelled in Barrett's head, he knew he needed a Hollywood connection to round out his vision. This, too, fell fortuitously into place. Mike Backes, a veteran screenwriter who collaborated with Michael Crichton on *Rising Sun* and was display graphics supervisor on *Jurassic Park*, had borrowed some equipment from SuperMac for use on *Jurassic Park*. To repay the favor, he gave the SuperMac employees a private screening of the film on the day of its release. At lunch afterward, Barrett and Blank mentioned to Backes the plan to start a games company; Backes was so taken with the idea he agreed to come in as a co-founder. He also suggested calling Ron Cobb, a Hollywood concept and production designer whose credits include *Alien*, *The Abyss*, *Conan the Barbarian*, and *The Last Starfighter*. Barrett thought Backes was kidding, but Backes made the call and Cobb agreed to join Rocket Science on the spot.

When word got out about this wild new company, a cavalcade of top names began clamoring to sign on. Executive producer Mark Mullen came from Industrial Light & Magic, where he had worked with Paul McCartney and had made commercials for Chrysler and American Airlines. Game designers Brian Moriarty (*Loom*, *Beyond Zork*, *Trinity*) and David Fox (*Indiana Jones and the Last Crusade*, *Zak McKracken and the Alien Mindbenders*, *Labyrinth*), moved over from the Lucas companies. David Brownstein, Matthew Fassberg, and Tony Payne, whose combined awards and production credits in feature films, television, and music videos would fill a fat book, were hired to oversee the first two Rocket Science titles. Rich Cohen, an ILM digital-effects master who worked on *Terminator 2* and *Total*



Rocket Science's design headquarters are in Berkeley, California. Clockwise from upper left: plotting game scenarios; artists refer to a wall of futuristic images; hashing out deadlines during long production meetings; model-making for *Loadstar*; a matte painting to be used as a background in *Loadstar*; crafting a meteorite from clay; sorting through blueprints; and conferring with CEO Steve Blank, who favors that classic sports-jacket-and-baseball-cap look.





Pipeline

Interview by John Battelle

How did James Gleick, famous science writer, come to be a franchiser of Internet service?

Wired: How did you, a book writer, turn into a telecommunications entrepreneur?

Gleick: My first plunge into the Internet came when I was working on a piece last year for *The New York Times Magazine* about the future of telecommunications. Like so many other people, I made my way onto the Net through one of those horrifying raw Unix sites – you know, dollar-sign prompt, incomprehensible command-line parameters, snotty error message if you were so gauche as to type “dir” instead of “ls.” It was a serious cold shower. I’m not a complete idiot – I can do a little bit of programming if you hold a gun to my head – but Unix was a shock. The Internet was a magnificent new world, and I could see that amid a lot of bravado, people were feeling a bit lost. I remember a characteristic posting from a new user begging for help: “Well, here I am – but where’s the Internet?” That’s how it still is for most Internet users. You’re in the dark.

But everyone complains about the Internet. So why you, and why now in your life?

A combination of things. One was that I happened to know a brilliant programmer – just how brilliant I found out later – who was in exactly the same boat I was in. His name is Uday Ivatury. He was discovering the Internet and had the same feeling about it. We started calling up access providers and telephone companies, and we realized that we could just do it. From my point of view, the worst thing that could happen would be that I’d blow six months and then go back to writing a book. I really didn’t look too closely at the other end of the range of possibilities, didn’t think I’d end up a sort of accidental entrepreneur.

Wasn’t it difficult to make the Pipeline interface, especially the Web browser, within the parameters of Windows and a dial-up line? How was it done?

What was difficult was realizing how much *could* be done. I remember standing late one night on the roof of the Manhattan Bridge Club with Uday, working out the software’s architecture. He was pacing back and forth, so I was pacing back and forth to keep up, and I realized that he was talking about managing simultaneous communications sessions in different windows – real Internet multitasking. Absurd! I told him: “Now wait a second – you can’t do that in Windows.” No one had, anyway. We tell people that we have multitasking communications software that runs under Windows, and they don’t believe it.

Well, you did it, so why now are you licensing it instead of just becoming the service everyone wants to subscribe to?

I believe the magic of the Internet is its multifarious, noncentralized, democratic, and even anarchic quality. I think it’s already clear that the era of the giant private online service has come and gone. Personally I have no ambition to create an online empire – I’d rather see what can be done with a gateway that retains a sense of its local roots. We’re also taking the view that no one, certainly not us, is smart enough to know what’s the “right” kind of online service. Let a thousand flowers bloom.

Who you do consider your competition?

We can provide things here in New York City that are of interest to New York users. I expect us to be delivering pizzas and videos in New York and helping New York public interest groups get their stuff online, and all sorts of things that national services can’t do.

So you’re the local station?

I believe in things that are local, even on the Internet, which is so majestically global. In a sense, the answer to your question is that all of us together are competing against places like CompuServe and America Online, which are dinosaurs. As large as they’ve grown, I just don’t think that kind of service represents the future.

How much have you grown since starting out?

At the moment we’re doubling every two or three months. About 3,000 people joined us in our first six months – a tiny number, of course, and we expect that to double, then double again.

Everyone is spinning these information superhighway dreams. Do you really think that we’re going to be talking about real-time video mail and the like in the next decade?

It’s going to be a while before we have that much bandwidth. All you have to do to get drenched with a bucket of cold water is call your local telephone company and try to order an ISDN line. I do think that those things are going to come. But I don’t think they’re going to come because they’re being planned from the top down by the giant entertainment companies.

Do you have any really good horror stories about installing phone lines for your services?

The local telephone companies *have* the right technology for a business like mine, and they have smart people who understand what the right technology is. But they *don’t have* a bureaucracy that’s capable of delivering that technology to your office. New York Telephone could bring into our office any capacity digital service we wanted. Instead, the only solution they can come up with is individual old-fashioned business lines. So we’ve got walls covered with them. We have fancy state-of-the-art modem racks that will take a T1 directly, and we have ISDN routers, but instead here’s Nynex giving us two copper wires for every line. It’s insane. They’re wasting telephone numbers – not an insignificant resource in New York City.

What do you make of the Time-Warner Orlando video tests and the like?

It’s not a surprise to me that these experiments are having so much trouble. There are so many things that have to be grappled with at the same time. I’ve visited the telephone company laboratories and seen the video servers and the digital network applications – the demonstrations are great – but the reality is no one has yet solved the human problems, how you channel surf through 500 channels instead of 50 channels. Technologies are hard to impose on people – even people who are desperately eager for them. ■ ■ ■

James Gleick is best known for his illuminating books probing the minds and issues raised by science and technology. *Chaos: Making a New Science and Genius: The Life and Science of Richard Feynman* are required reading for any lay person interested in the course of modern-day science. While he considers himself an author at heart, Gleick couldn’t resist the chance to become part of the telephonic world that he was scrutinizing for his next book. In the summer of 1993, he founded The Pipeline Network Inc., an innovative Manhattan-based online service that offers a direct connection to the Internet as well as to a local “scene.” Its seamless, painless interface, complete with what may be the first World Wide Web browser requiring only a modem, quickly caught on, and as of early fall, Gleick had licensed The Pipeline’s core software to more than 15 independent and corporate service providers. Wired Managing Editor John Battelle caught up with Gleick in his Brooklyn Heights home.

P A T R I O T



Can Chrysler dazzle both the ecology fanatics and the gearheads with a LeMans race car based on once-supersecret technology made suddenly available at bargain prices by the collapse of the defense industry? Jon Lowell looks at what could be the shape of auto racing in the 21st century.

In a world of ever-tightening auto emissions standards, auto makers are racing to redesign their cars to be ecologically correct while still retaining the loyalty of hardcore gearheads. The Chrysler Corporation moved quickly this

year to outflank its rivals — by turning ecological correctness from dreadful duty into something sexy, powerful, and fun. The company's strategy is embodied in the Patriot, a very low-exhaust-emissions, 200-mph, hybrid electric race car

with which it plans to win next June's 24 Hours of LeMans in the north of France.

LeMans is the most prestigious endurance auto race in the world. For a manufacturer, winning it ranks above the Indianapolis 500, the Formula One

championship, or the Daytona 500. For Chrysler, however, Patriot is not just a racing program, it is "first and foremost a

Jon Lowell is an auto enthusiast and freelance writer based in Detroit, Michigan.

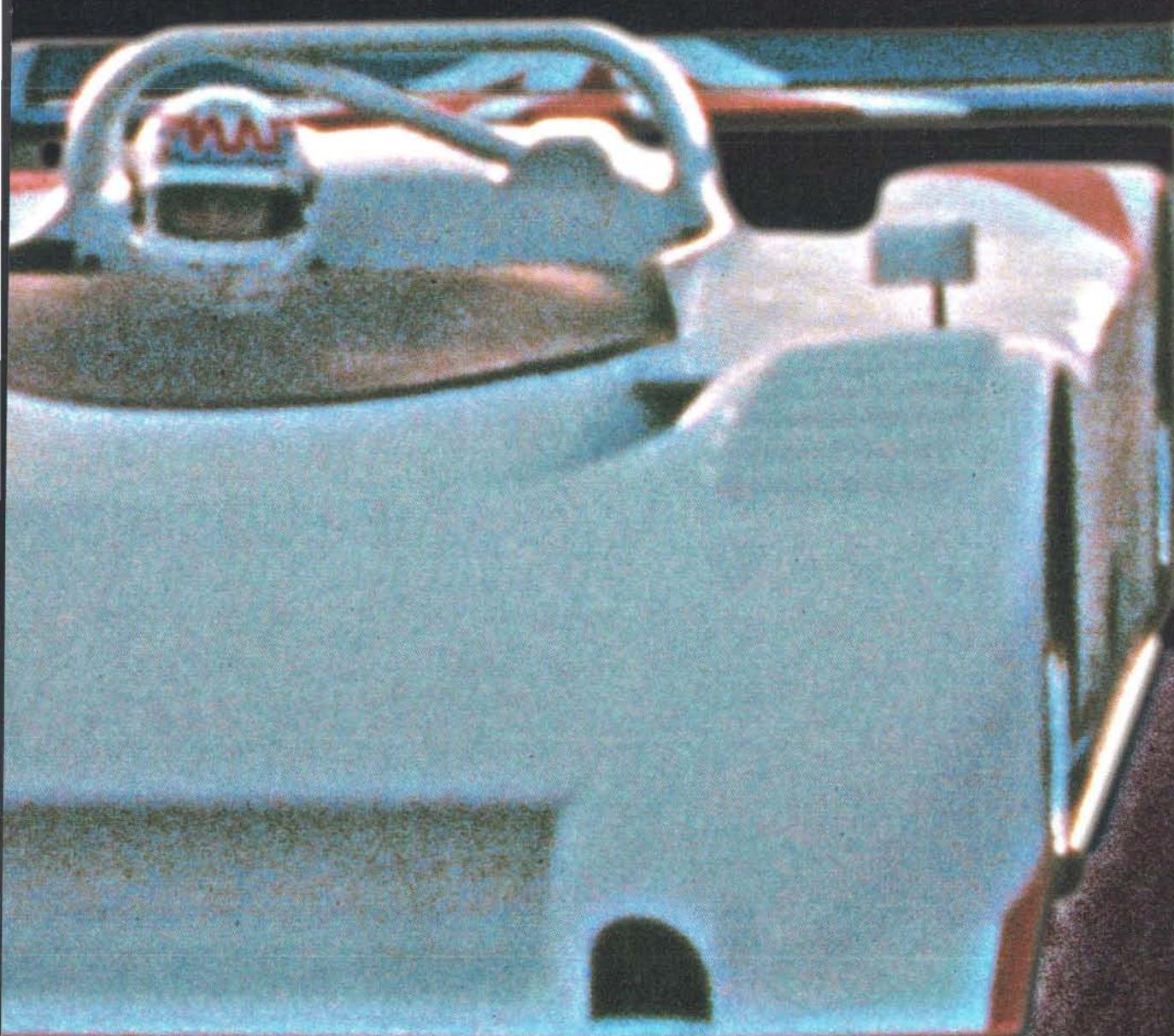
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technology program," insists Thomas Kizer, executive engineer for Chrysler's low-profile Liberty and Technical Affairs advanced research organization. Racing, he adds, merely provides "the pressure cooker for the technology."

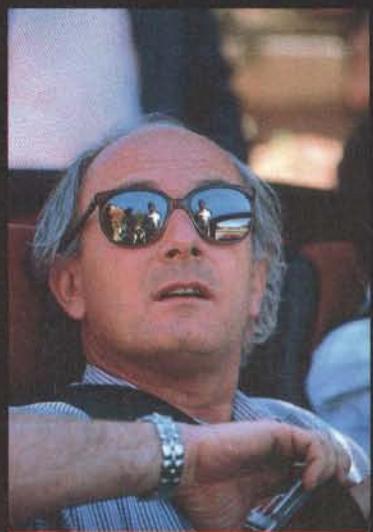
For Chrysler, the third-largest US auto maker, making a big international splash is a major piece of what the Patriot program is all about. To ride out the ups and downs of the US auto market, the company badly needs a larger presence in

Europe and the rest of the world. Winning LeMans with a breakthrough hybrid race car would provide instant glamour and dramatically boost technical credibility. In short, the Patriot program is a corporate image campaign.

But the story doesn't stop there. The Patriot will be powered by parts and pieces that until very recently were top-secret components of cutting-edge defense research projects, including the Star Wars missile defense system and the Seawolf

advanced nuclear attack submarine. Perfectly legally, Chrysler's technology has been developed with millions of dollars in US taxes and purchased at post-Cold War bargain prices.

The Big Three auto makers and the federal government are now tied together in the Partnership for a New Generation Vehicle (known as the "Supercar" research program), a massive effort to provide US-owned car makers with the technology to produce traditionally sized vehicles with extremely low emissions and ultra-efficient fuel usage. "Every day we see



Chrysler's French-born vice president of engineering, Francois Castaing, hopes to convince people that green cars can be as powerful as any traditionally designed race car.

"new things from the defense labs where they have declassified item X or Y," says Al Turner, Patriot general manager and a veteran of special programs at both Chrysler and Ford. Most cutting-edge technology, Turner notes, has never appeared in conventional technical literature or patent applications.

In recent years, once-arrogant, defense-bankrolled labs like Lawrence Livermore and Los Alamos have participated in what looked like technology bake sales. One invitation-only event was held in the General Motors Corporation Design Auditorium four years ago: in

dozens of booths under the GM dome, eager researchers from government facilities, like so many used car dealers, button-holed bemused auto suppliers.

At the time, most auto executives feigned only mild interest, but the last two years have seen contracts for everything from crash simulations on federal supercomputers to weapons-lab studies of manufacturing methods for lightweight materials. And the federal researchers are becoming better salesmen.

"If you want to see the neat stuff, you can go look for it at the patent office, but do you think it's going to be there? Hell no!" Turner says, waving a notebook filled with brief summaries of available but unpatented defense technology. Chrysler says it will eventually turn over most Patriot research data to the Supercar effort. But for now it plans to win LeMans.

Patriot's relatively conventional sports-car chassis will be powered by a completely unproven hybrid electric powertrain. First shown in January 1994 at the North American International Auto Show in its since-shelved Mark I version, it will defy racing tradition by debuting at LeMans. Chrysler is convinced it can dazzle both the ecology movement and the tire-smoke-sniffing gearheads of the world using once supersecret technology suddenly available and cheap following the collapse of the defense industry. The Patriot is a calculated risk. Until late this year, it will exist more in theory than in fact. The Mark I prototype only saw the road during a coasting photo-op.

Patriot is not a true electric car. As a hybrid, it evades the single major stumbling block of pure electric vehicles: a battery capacity that prevents even smallish cars from traveling much beyond 100 miles without a recharge. Small onboard engines acting as generators eliminate that problem but produce some hydrocarbon

emissions. Chrysler has avoided the battery problem altogether in the Patriot design by using a flywheel (conceptually similar to a child's gyroscope) to store energy, rather than traditional, heavy chemical batteries like the ones found in electric cars.

The car body is being built by British race-car constructor Reynard (of Indianapolis fame) in Bicester, England, according to the rules used by both LeMans and the International Motor Sports Association, a US racing organization that runs events such as the 24 Hours of Daytona. Patriot will have a fairly conventional open-cockpit design not unlike current racing model Ferraris. It will make extensive use of exotic materials like carbon fiber but use proven racing suspension technology.

For the guts of the Patriot engine, Chrysler tapped SatCon Technology Corp., based in Cambridge, Massachusetts. Quietly spun out of MIT's Charles Stark Draper Laboratory in 1985, the 120-employee engineering research firm went public in late 1992. The company specializes in work on advanced flywheels, turbines, exotic electric motors, and magnetic levitation applied to machinery for semiconductor manufacturing. For Patriot, SatCon is developing the powertrain – the engine, transmission, and fuel system. SatCon's past contracts have involved such secretive efforts as the Navy's US\$2 billion Seawolf high-performance nuclear attack submarine and parts of Star Wars. David Eisenhaure, president and CEO of SatCon, says that the pieces of technology going into the race car were originally designed for defense and NASA projects.

The ultimate test of the car's performance lies in how successfully the Patriot powertrain is engineered. "Lots of companies out there are doing math modeling of hybrid vehicles," explains Chrysler's Kizer. "But

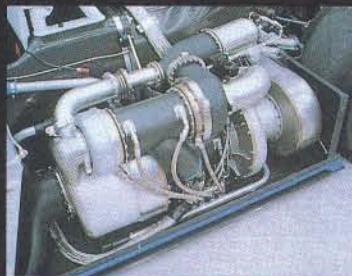
no one has ever put one together to do the job we're expecting it to do." SatCon is working on the details of the Patriot powertrain not only in its Cambridge headquarters but in an unmarked one-story suburban business complex a few miles from Chrysler's stunning new \$1 billion headquarters, where SatCon collaborates with Chrysler engineers. In addition to Patriot, its researchers are working on technologies like fuel cells as future automotive power sources.

The basic theory of the Patriot powertrain is fairly straightforward. Vaporized liquid natural gas (LNG) is burned to spin turbo alternators that will run at varying speeds. One of the alternators runs up to 60,000 rpm, while a second can spin close to 100,000 rpm. The turbo alternators generate electricity, and power not being used by the electric drive motor to power the car is stored as rotational energy in the flywheel. To reach top speeds of over 200 mph, the electric drive motor will draw power from both the alternators and the flywheel. If you're around a Patriot prototype, there's no mistaking the sheer muscle of the engine: it whines like a 747 idling on the runway.

One of the Patriot team's biggest concerns is ensuring that its high-powered hybrid is safe. The slightest accident in front of thousands of watchers from around the world could destroy Chrysler's credibility and negate the thousands of hours and millions of dollars put into the Patriot effort. Electric cars can be dangerous. At a race in Phoenix three years ago an electric car charged by experimental batteries crashed, triggering a bromine gas spill. The driver suffered what turned out to be relatively minor respiratory problems, but the crash set off a brief panic. No one was certain how much of a threat the gas, which quickly dissipated, represented. In the case of

Patriot, engineers are plotting ways to deal safely with both the supercold LNG fuel and the massive amounts of electricity that will be available in the car.

To get up to speed on the complexities of fooling with LNG, Chrysler has been consulting with Los Angeles-based Cryogenics Experts Inc. (CEXI). Another Star Wars-funded company, CEXI has designed space-shuttle ground support fueling systems. CEXI experts say that what they have proposed for the Patriot is perfectly safe. The supercold gas will be loaded from tanks, using insulated hoses, at about the same speed as traditional gasoline. When LNG isn't handled with appropriate care, the frigid fuel causes water from surrounding air



The twin turbo alternators housed in this casing generate the electricity used to power the Patriot. They run at speeds of up to 100,000 rpm.

bon fiber disc that spins in a near vacuum at speeds up to 56,000 rpm. It will operate like a traditional battery and a generator in a car. Components are being tested individually in a specially modified dynamometer cell in Chrysler's now largely abandoned old engineering facility in Highland Park, Michigan, where the flywheel has been the focus of suspicious study. "People have spun discs at high speeds in vacuums in laboratories," says Kizer, "but we're trying to bolt one into a car." Among other things, the flywheel has to be mounted on gimbals to isolate its gyroscopic effects from the handling of a speeding car turning corners.

Patriot's electricity levels are something else again. "The



Spare power is stored as rotational energy in this flywheel, a carbon fiber disc straight from the Star Wars project. It spins in a near vacuum.

ponents demonstrate their individual reliability in the lab, they will be linked to each other mechanically for further testing. Eventually, the entire powertrain will be run by a computer-driven simulation of a typical racing lap at LeMans that will put it through the stresses of rapid acceleration and deceleration of the 24-hour race.

Because of the intense vibrations a car encounters at racing speeds, the Patriot team is subjecting to particular scrutiny three separate de-ionized water-cooling systems that handle the heat generated by the power controller, turbo alternator, and various bearings and stators. De-ionized water doesn't conduct electricity. Heat from one of the cooling systems



Between the rear wheels are the traction motor and the gear box, which transfers about 864 amps to where the rubber meets the road.

as any of the world's traditionally designed racing cars."

Nobody outside the top ranks at Chrysler really knows how much all this might end up costing. The only public number is a \$4.1 million contract to SatCon, but scores of highly paid engineers have already been enlisted to work full time on the Patriot project. To win LeMans in the mid '60s, Ford reportedly spent more than \$11.5 million, and bought an entire hotel to house the army of people involved. "We'll spend whatever's necessary," pronounces Castaing, who seems certain Chrysler's team of engineering alchemists can mix racing, the green movement, and the defense establishment to create a revolutionary car for the future.



A Patriot prototype with the front section exposed, showing the carbon fiber tub in the front of the car. Light, mean, green: can this car win LeMans?

to condense, which in turn creates mini storm clouds. Chrysler's Turner is confident that he has the LNG under control. "You hear talk about fueling vapor but you won't see any storm clouds," he says. Then he adds, with a chuckle, "We might want to do that just to make it spectacular."

One of Chrysler's own point men on the Patriot project is Lee Carducci, manager of powertrain integration, who's also involved with the auto maker's equally exotic partnerships with Italian high-performance auto boutiques Maserati and Lamborghini. "I'm no big fan of Ronald Reagan, but he gave us our flywheel," grins Carducci, 32, saluting Star Wars. The flywheel he's referring to is a car-

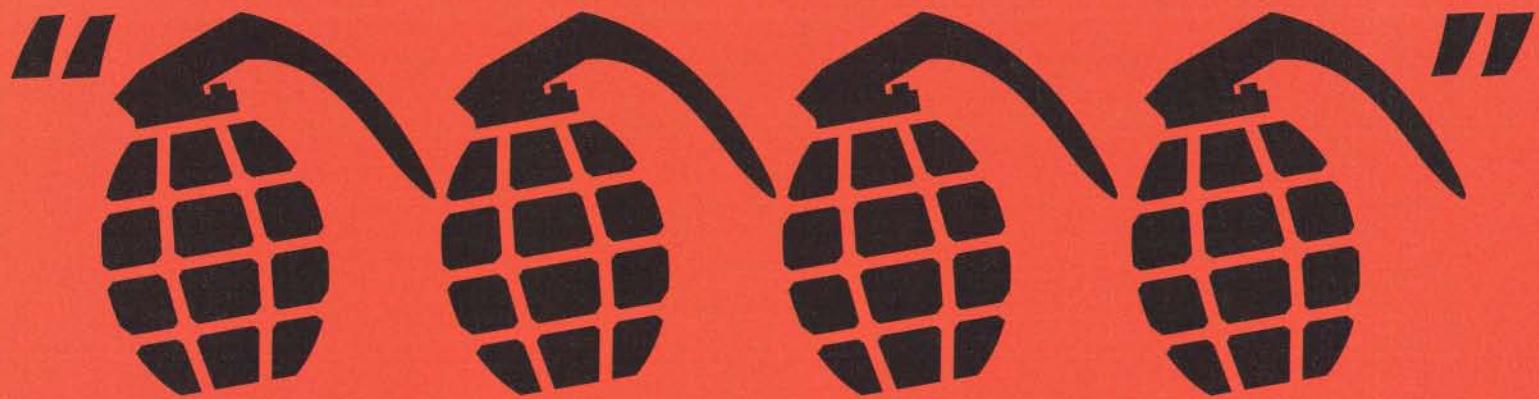
system controls about 800 volts," says Carducci, who is more comfortable with Formula One V-12 engines. "It's got about 864 amps. The power controller is transferring enough power to handle 300 homes in a subdivision." Carducci jokes he initially thought Patriot would need a transformer "20-feet high," but was impressed when SatCon came in with a box only 2 feet long and 9 inches high. "They said it was something just off the Seawolf program." The stored electricity requires great caution on the part of those working around areas such as the flywheel, for example, which will be spinning at very high speeds even when the car is stopped.

As various powertrain com-

will be used to vaporize the cryogenic fuel.

Using the noise and smoke of the auto-racing circuit to demonstrate ecologically correct electric motors is an ambitious gamble for Chrysler, especially since most automotive performance enthusiasts tend to view electric cars as thinly disguised golf carts. But this year's Chrysler team seems irrevocably intent on winning LeMans in 1995. "People think green is boring," says Chrysler's French-born engineering vice president, Francois Castaing, who is fond of challenging those who raise eyebrows over the unorthodox effort. "We're hoping to keep green and fun together, and convince people green cars can be as powerful

A win for Chrysler's ultra-low-emissions Patriot could enhance Chrysler's image both with the speed-crazed high performance crowd and with fans of more ecologically friendly vehicles. But a humiliating loss could leave the company consigned to technology's gag reel, remembered by future historians along with the guys on ice skates strapping rockets to their backs. Despite some initial skepticism, many racing enthusiasts are intrigued and even fascinated by the Patriot. "The whole thing sounds a little goofy," said one Indy racer, "but I'd drive it in a minute. The Patriot could produce a new generation of race cars. And a new generation of fans." ■ ■ ■



Welcome to the Next Level of the videogame biz,
where if you don't grovel and adopt ratings,
some senator will rip your head off. By Rogier van Bakel

Illustrations by Steve Speer

There was never a problem with *Pong*. That crude table-tennis ball bouncing across the screen was about as violent as a Hare Krishna on Prozac, and roughly as exciting.

So maybe the problem started with *Pac Man*. We happily made the critter devour other members of its species. Just a game. Hindsight being 20/20, we can now see that this nonchalance was unforgivable. We never pondered the social implications of the portrayal and encouragement of mindless cannibalism. It's entirely possible that Jeffrey Dahmer played too many hours of *Pac Man* as an impressionable teen.

Nowadays, with the manufacturers of interactive games grossing more than the movie industry, the problem is big. Huge. Out of control. Violent games such as *Doom*, *Night Trap*, and *Mortal Kombat* are corrupting the minds and morals of millions of American children.

So what do you do? Easy.

You elect people like Herb Kohl (D-Wisconsin) and Joe Lieberman (D-Connecticut) to the US Senate.

You applaud them when they tell the videogame industry that it's made up of irresponsible purveyors of gratuitous gore and nefarious nudity.

You nod contentedly when the senators give the industry an ultimatum: "Either you start rating and stickering your games real soon, or we, the government, will do it for you."

You are pleasantly surprised by the industry's immediate white flag: a rating system that is almost as detailed as the FDA-mandated nutrition information on a can of Campbell's.

Anagram enthusiasts will find that Rogier van Bakel (rogiernl@aol.com) has Brave Ink Galore. Van Bakel is a Dutch journalist lost in Washington, DC.

You contend that that is, in fact, a perfect analogy: all you want, as a consumer, is honest product labeling. Campbell's equals Sega equals Kraft equals 3DO.

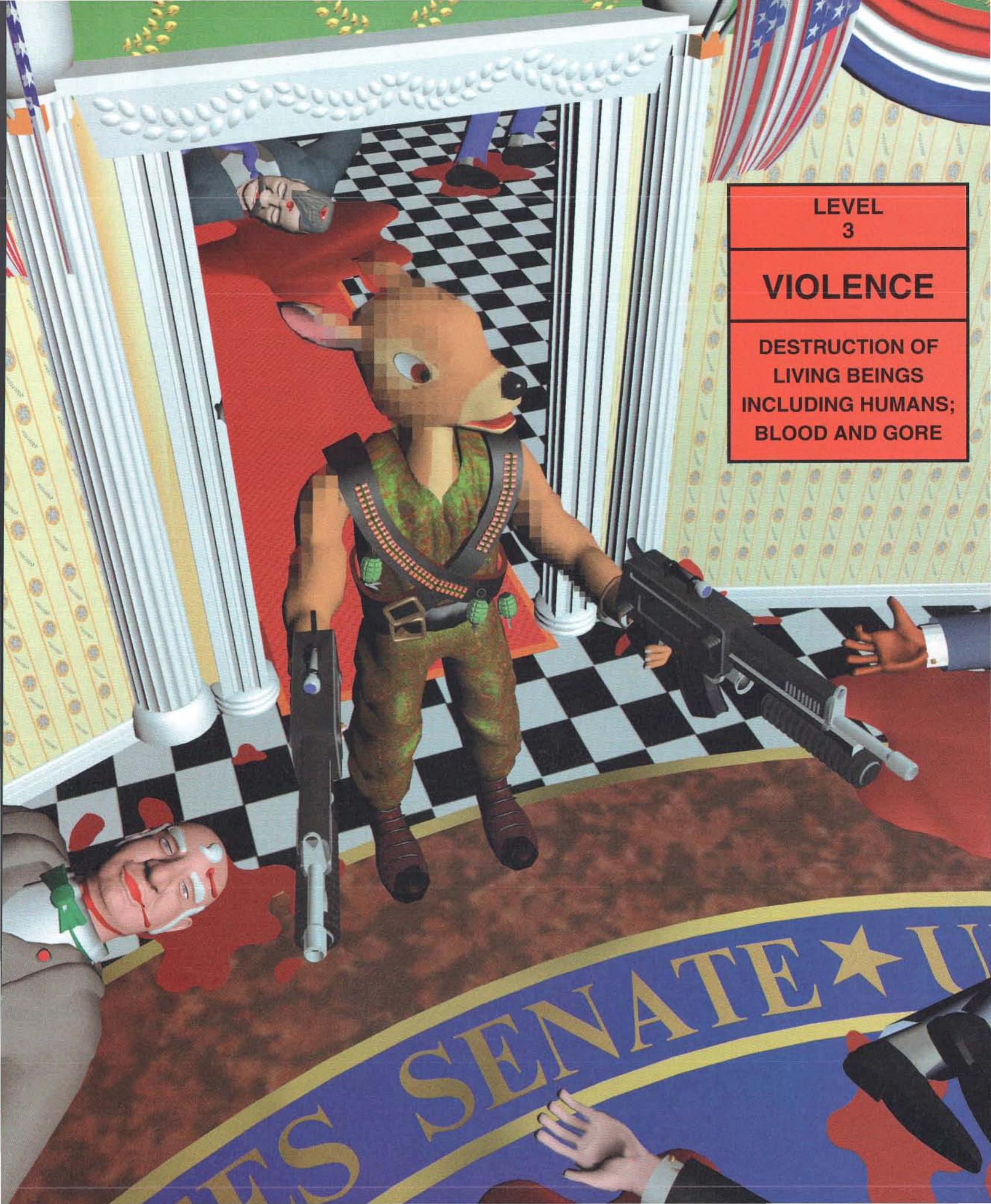
Finally, you shrug when someone remarks that it may not be a good idea to equate soup with freedom of speech.

Set it on fire

Lately, violence in the media has become the *crise du jour*. A year ago, Attorney General Janet Reno told Hollywood executives that they had better start toning down the acts of aggression in television programs, or she would have federal agents raid the executives compound and set the whole goddamn place on fire. (Well, *almost*.) Surfing the wave of indignation and despair over what many see as an explosion of violent crime (despite the fact that the violence graph has actually been pretty flat for years), senators then grilled emissaries of the video- and computer-game industry in a hearing in December 1993. The industry was bluntly ordered to devise a rating system that, in Capitol Hill-speak, was to be "totally voluntary."

Politically and financially, this was a smart move. Make that a masterstroke. Says Sloan Walker, an aide to Senator Lieberman: "He wanted to do it without government interference, without the government having to run a big rating effort and then pay for it." The whole thing, of course, was about as voluntary as a 10-year-old finishing his plateful of spinach after Dad threatens to cram the stuff down the kid's throat. To continue the metaphor: Dad then makes Johnny pay for the spinach and laughs. Hard.

Industry bigwigs, when first confronted with congressional scorn for many of their products, muttered that they were being sufficiently sensitive and responsible already. Some of the manufacturers – most notably Sega – had already adopted a rating system of their own,



**LEVEL
3**

VIOLENCE

**DESTRUCTION OF
LIVING BEINGS
INCLUDING HUMANS;
BLOOD AND GORE**

roughly similar to that of the Motion Picture Association of America. But they apparently feared the public relations fallout if they did not do more. What would consumers think if the industry created the perception that it was unwilling to disclose the potentially objectionable content of its games? So Sega, Nintendo, and most of their allies, or competitors, never went head-to-head with their critics in Washington.

No sex lives

Not that plenty of annoyance wasn't voiced around corporate coffee machines. Certainly, there were numerous gripes on electronic bulletin boards, such as these remarks made in game developers and players forums on CompuServe:

- "Only people who don't have computers want software ratings. It's like those people with no sex lives who want to dictate others' sexual morality."
- "What about the game Hangman? Talk about a gory concept; guess a word and hang somebody. We're talking about pixels, not flesh and blood. The problems of this world are not caused by videogames. They're all due to Beavis and Butt-head."
- "These people in Congress are all liberals. Imagine what the Right will do."
- "Once again, the government is forcing the unwilling to do the unnecessary for the ungrateful."

Karen Crowther, president of Redwood Games Inc. and spokesperson for an umbrella group of shareware publishing associations, is suspicious of the Senate's motives. "Congress is on a holy war against violence and offers ratings as a simplistic cure to misdirect the public's attention from the very real social problems of endemic poverty, discrimination, damaged social and familial support systems, and economic hopelessness."

But that kind of talk never made it to the crucial third hearing on video- and computer-game violence in late July 1994 (there had been a second "progress report" hearing in March). No Mortal Kombat ever took place on the Senate floor. Indeed, the whole affair seemed more like *Super Mario Brothers at the Love-In*. The pusillanimous comments at the hearing astounded anyone who had expected reluctance, defiance, or political strife. Industry executives praised the senators for their "leadership," for giving them a "wake-up call," and for being "an inspiration." Then, the two factions of the interactive-game business – cartridge and CD-ROM games manufacturers united as IDSA, the Interactive Digital Software Association, and PC game makers, operating jointly with the Software Publishers Association – presented

two rating systems that now exist concurrently. (See box, page 152) Both were implemented in the early fall, with rated products scheduled to hit store shelves in November, just in time for the annual Christmas shopping spree.

Lieberman and Kohl were duly impressed. "This is a huge American success story," said Kohl (while chiding the industry in the next breath for not coming up with one uniform rating structure). "You've met the challenge," added Lieberman, sounding like a dean addressing an auditorium of fresh-faced graduates. "You have created the most informative and comprehensive rating system of any entertainment medium in this country."

Clearly, the industry had outdone itself in what many call a laudable demonstration of corporate responsibility. "These self-policing measures are a confirmation of the fact that the business has gone from a cottage industry to one that has annual revenues of US\$5.5 billion to \$6 billion," explains Gregory Fischbach, chair and CEO of Acclaim Entertainment Inc., whose *Mortal Kombat* had drawn the ire of the senators last December. "We've been very much a part of the creation of the system, and I think the results are very good."

But others aren't so quick with their hurrahs. They believe that politicians who bully artists, authors, and their companies into self-censorship run afoul of the First Amendment. They also hold that the battle has yet to begin.

Fault line

Robert Peck, legislative counsel with the American Civil Liberties Union, believes the game industry's rating system is built on a constitutional fault line, that

it's a structure waiting to implode the moment someone gives it a good kick. Why? Because the First Amendment not only protects speech; it has also been interpreted by the Supreme Court to be an absolute shield from government-compelled speech. "This system is a response to the threat of Senators Lieberman and Kohl that they would enact legislation requiring labels, unless the industry did something to preempt them," says Peck. "The game manufacturers are being required to engage in speech that they would otherwise not engage in, by virtue of the fact that they didn't [uniformly] label these games themselves, earlier. These ratings have the government's fingerprints all over them."

A parallel conflict arose in a six-year-old Supreme Court case, *Riley v. National Federation of the Blind*. According to Peck, in this instance, the state of North Carolina required that any charitable solicitation

RSAC CONSUMER SOFTWARE CONTENT GUIDE				
ALL SUITABLE FOR ALL AUDIENCES	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4 EXTREME CONTENT
VIOLENCE				
HARMLESS CONFLICT; SOME DAMAGE TO NON- LIVING THINGS	DAMAGE OR DESTRUCTION OF NON-HUMAN LIVING BEINGS	DAMAGE OR DESTRUCTION OF LIVING BEINGS INCLUDING HUMANS; SOME BLOOD	DESTRUCTION OF LIVING BEINGS INCLUDING HUMANS; BLOOD AND GORE	WANTON OR GRATUITOUS VIOLENCE; TORTURE; RAPE
NUDITY/SEX				
NO NUDITY OR REVEALING ATTIRE ROMANCE; NO SEX	REVEALING ATTIRE PASSIONATE KISSING	BARE BUTTOCKS; BRIEF DISPLAY OF FEMALE BREASTS CLOTHED SEXUAL TOUCHING	NON-SEXUAL FRONTAL NUDITY NON-EXPLICIT SEXUAL ACTIVITY	PROVOCATIVE FRONTAL NUDITY EXPLICIT SEXUAL ACTIVITY; SEX CRIMES
LANGUAGE				
INOFFENSIVE SLANG; NO PROFANITY	MILD EXPLETIVES AND PROFANITY	MODERATE EXPLETIVES; NON- SEXUAL ANATOMICAL REFERENCES	STRONG LANGUAGE; OBSCENE GESTURES	"FOUR-LETTER" WORDS; CRUDE OR EXPLICIT SEXUAL REFERENCES

The SPA's ratings, to be implemented by the Recreational Software Advisory Council, are assigned by a computer that calculates the outcome based on an electronic questionnaire.

include details on how much money was going to professional fundraisers, and how much was actually going to the charity. Although this information would have benefitted charitably inclined citizens, the Court viewed the requirement as compelled speech and struck it down.

"If something as innocuous as that is ruled a First Amendment violation," reasons Peck, "I have no doubt that this rating system would have the same constitutional flaw."

Every time a new medium comes along, the impulse exists to regulate it. "It's sad, really," says Mike Godwin, a lawyer with the Electronic Frontier Foundation, a nonprofit watchdog group that guards against attacks on civil liberties in cyberspace. "It's true with printing presses, which were licensed by the state for centuries before we got a free press; it's true with radio and movies. Government always has trouble coping with new media. And then, over time, people begin to realize that these media really do deserve First Amendment protection."

Godwin believes that no one could make a constitutionally sound case for regulating any medium on the basis of its supposed lack of social or artistic value. In other words, Game Boy's *Super Battletank* may be shorter on intellectual content than Sergei Eisenstein's *The Battleship Potemkin*, but it's all the same to the law of the land: they're protected in equal degrees.

But why not give consumers information about the products they're thinking of buying or renting? "The problem is that media are not merely a product," argues Godwin. "They're modes of expression. There's no First Amendment that applies to the selling of food or manufactured goods. However, there is one with regard to the selling of entertainment."

Images are dangerous

But some people believe the senators have been far too benign and that the industry is not going far enough in policing itself. Brian Stonehill, director of the media studies program at Pomona College in Claremont, California, and the author of the upcoming book *What to Watch For: A Handbook of Visual Literacy*, makes a distinction between ideas and experiences. Books, he says, are a reflection of ideas, whereas playing a videogame is more of an experience – however based on ideas the game may be.

"I think we should allow both categories as much First Amendment protection as we can give them, but freedom of speech is not an

absolute given. We have no right to holler fire in a crowded theater; there are libel and slander laws that prevent people from recklessly saying anything they want. The law basically says that you have to be responsible in exercising your freedom of speech."

Stonehill, who would advocate a rating system that alerts parents to sexist and racist content, in addition to providing descriptors like "violence" and "nudity," worries specifically about visual media. He maintains that "there is a vast difference in susceptibility to printed text" on the one hand, and images on the other. "The mediation of print means that people have achieved literacy in order to get at whatever's in the text. But when you deal with visual media, you've

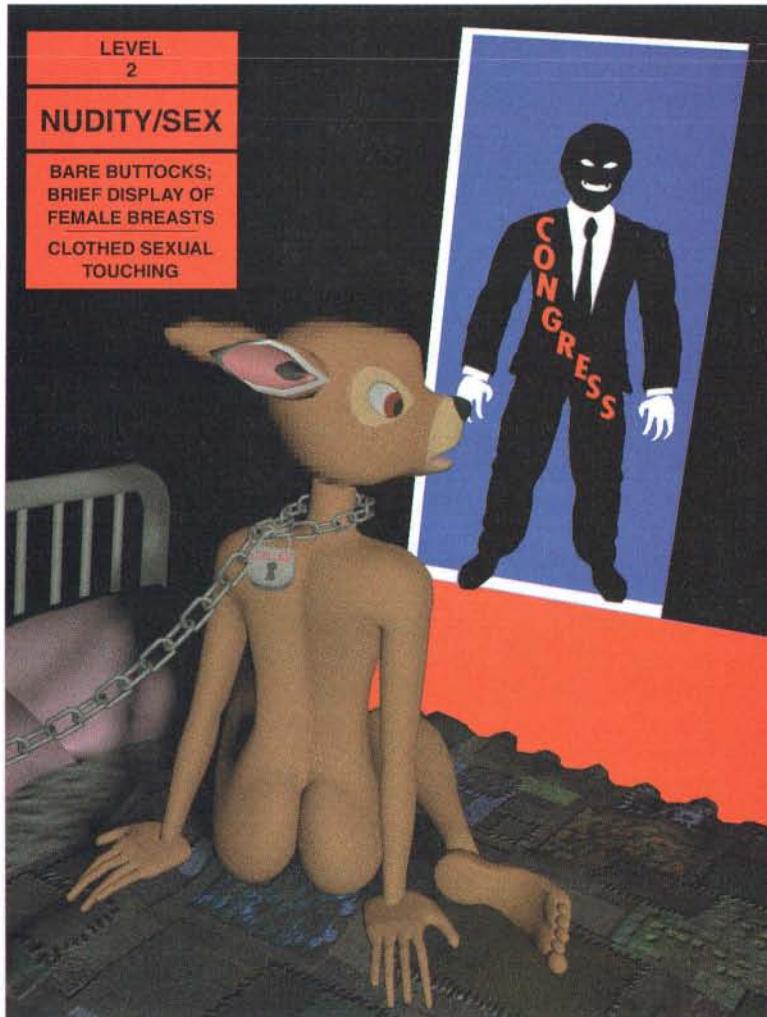
done away with the mediation of print and gone directly to something that any illiterate, any child, has access to. Visual material is more direct and realistic, and therefore inherently more dangerous."

It is the same argument that critics used to cast doubt on the virtues of motion pictures before World War II and to vilify comic books, once widely presumed to do moral damage to young readers. (The argument even prompted a Senate investigation that drove comics underground in the early '50s.) In fact, that kind of finger pointing has been around for many centuries, argues James Twitchell, an English professor at the University of Florida in Gainesville, in his 1989 book *Preposterous Violence: Fables of Aggression in Modern Culture*. "Violent stories will always seem shocking to an older generation which had drawn its myths from a previous medium, but if one will listen closely, the same story will be endlessly told. The fantasies one generation considers escapist and

worthless – 'trash' – the next generation lines up to see."

Twitchell argues that this dates back at least as far as the bread-and-circus days of the Romans, and that it has remained a consistent, somewhat tiresome tug of war ever since. "Those who now cry that Stephen King's fiction travesties the novel forget that the novel itself was not so long ago accused of subverting literature," he writes. Critics of popular culture today are the spiritual descendants of the Victorian critics of popular print, issuing similar dire warnings. "To wit: the medium corrupts consciousness, the work ethic, natural desires, concentration, and culture itself. Somehow the dreck of the masses is changing the quality of an otherwise benign culture," mocks the author.

Twitchell, who focuses especially on modern horror literature, believes that what is commonly considered "the flotsam of







Jay Dunitz paints with electricity, literally.

PACIFIC LIGHT #28

It all started with an abandoned refrigerator. Photographer Jay Dunitz stumbled upon it in a neighbor's backyard and became entranced by the painterly qualities of its rusting metal surfaces.

Dunitz next found inspiration in a heap of discarded scraps of metal left to weather in a sculpture yard at the University of California, Berkeley. Photographing the jagged, rusty remnants, he captured an unexpected range of brilliant colors created by the material's oxidation. Thoroughly abstract, the eerie, iconic shapes had all the power of sun-baked ancient ruins. But Dunitz wasn't satisfied. "Rather than just collecting things and photographing them," he recalls. "I wanted to manipulate surfaces."

By 1984 he had begun the process used to create *Pacific Light #28* (shown at left). Picture Dunitz standing – in running shoes and latex gloves – on a foam pad, holding a paintbrush wired into a nearby power supply. Dipping this brush into an electrolyte mixture of water and baking soda, he then attacks the surface of sheets of reactive metals (steel, titanium, niobium, or tantalum). Electricity flows through the brush to the metal: by changing the voltage, he manipulates the layers of oxidation and, in turn, the colors – 30 volts for light blue, 60 for fuchsia, 100 for kelly green. Intermittently, he etches grooves and scratches into the surface with a grinder or wire brush. But it's the last step in the process, the photography, that gives Dunitz's work its shadows, turbulence, and dreamlike mystery. After weeks of exploring the plate's surfaces and toying with as many as 30 lights to illuminate one evocative image, Dunitz takes his shot.

The final result: Cibachrome prints up to 48 inches by 64 inches large. Reminiscent of the Abstract Expressionists, the lyrical light paintings can be inhabited by vast landscapes, marine vistas, dark forests, night skies lit up as if by the aurora borealis.

The color comes from light waves, not pigment, but the works hardly have a high-tech feel. "There's a certain spirituality represented by the brush stroke," says the Malibu-based artist, who studied painting long before photography. "There's more to it than the metal or than the image represented."

No longer caught up in "the novelty" of his wired-up method, the 38-year-old artist today is after something else: "The medium was more important than the message. Now, the message is more important." – Constance Hale

Dunitz's work is collected in *Pacific Light*, a book available directly from Dunitz: +1 (310) 456-9983.

PROPHET *of* PRIVACY

HE TOOK CRYPTOGRAPHY OUT OF THE HANDS OF THE SPOOKS

AND MADE PRIVACY POSSIBLE IN THE DIGITAL AGE,

BY INVENTING THE MOST REVOLUTIONARY CONCEPT IN

ENCRYPTION SINCE THE RENAISSANCE.

STEVEN LEVY DECODES WHITFIELD DIFFIE.

The heat on this steamy June day is oppressive, but Whitfield Diffie doesn't seem to notice. He strides across the street from his hotel to the Washington, DC, Convention Center like a smart bomb homing in on a bunker. He has prepared for the Armed Forces Communications and Electronics Association Expo and Convention with his usual compulsive vigor. Some days before, in his office at Sun Microsystems Computer Corporation in Mountain View, California – where he holds the title of distinguished engineer – Diffie examined the list of exhibitors and methodically charted a course through the convention center that would take him past every vendor or organization that offers something related to the field he has helped revolutionize: cryptography.

Diffie is quite at home in Washington. In the past 15 months he has testified three times before Congress and participated in a blue-ribbon panel on the future of crypto. This swing started two days ago, on his 50th birthday. He celebrated by having a quiet dinner with his wife, Egyptologist Mary Fischer. The following day he denounced the Clipper Chip at a conference organized by the Electronic Privacy Information Center. Now – accompanied by a small entourage of authors, including David Kahn (*The Codebreakers*), Bruce Schneier (*Applied Cryptography*), and me – he is ready to hit the convention floor of the Armed Forces show, where the theme of the day is "Digitizing the Battlefield."

Even if he weren't leading a crew of cypherscribes, Diffie would cut an imposing figure. From the neck down, he fits the conservative mode of the bureaucrats, techies, and spooks in attendance: blue suit with a neatly knotted tie over a blue shirt. But hovering over the suit are piercing blue eyes framed by shoulder-length blonde hair and a beard worthy of Buffalo Bill. Then there's his

unforgettable voice: Diffie speaks in a cutting tremolo that heightens the effect of his words, which are often already provocative.

Diffie has a chance to exercise these vocal proclivities as he jaunts from booth to booth, happily bantering with the purveyors of surveillance systems, crypto-protected jeep communications, and "situation awareness" helmets with built-in quanta-ray sensors. At one modest display he jokes, "For an outfit of your formidability, you've managed an economical booth." The exhibitors wilt. At another booth he is offered a chance to try out an encryption-equipped walkie-talkie. "Presumably, we'll discover it works just fine," says Diffie, refusing the demo.

Then Diffie reaches Booth 660, let by the National Security Agency. The agency is the world's largest repository of information about cryptography and usually operates under total secrecy. In these *après* Cold War days, however, the agency has been experimenting with a more public posture, and at the conference it has fronted two booths: this one, with its banner proudly unfurled, and an exhibit room off the show floor.

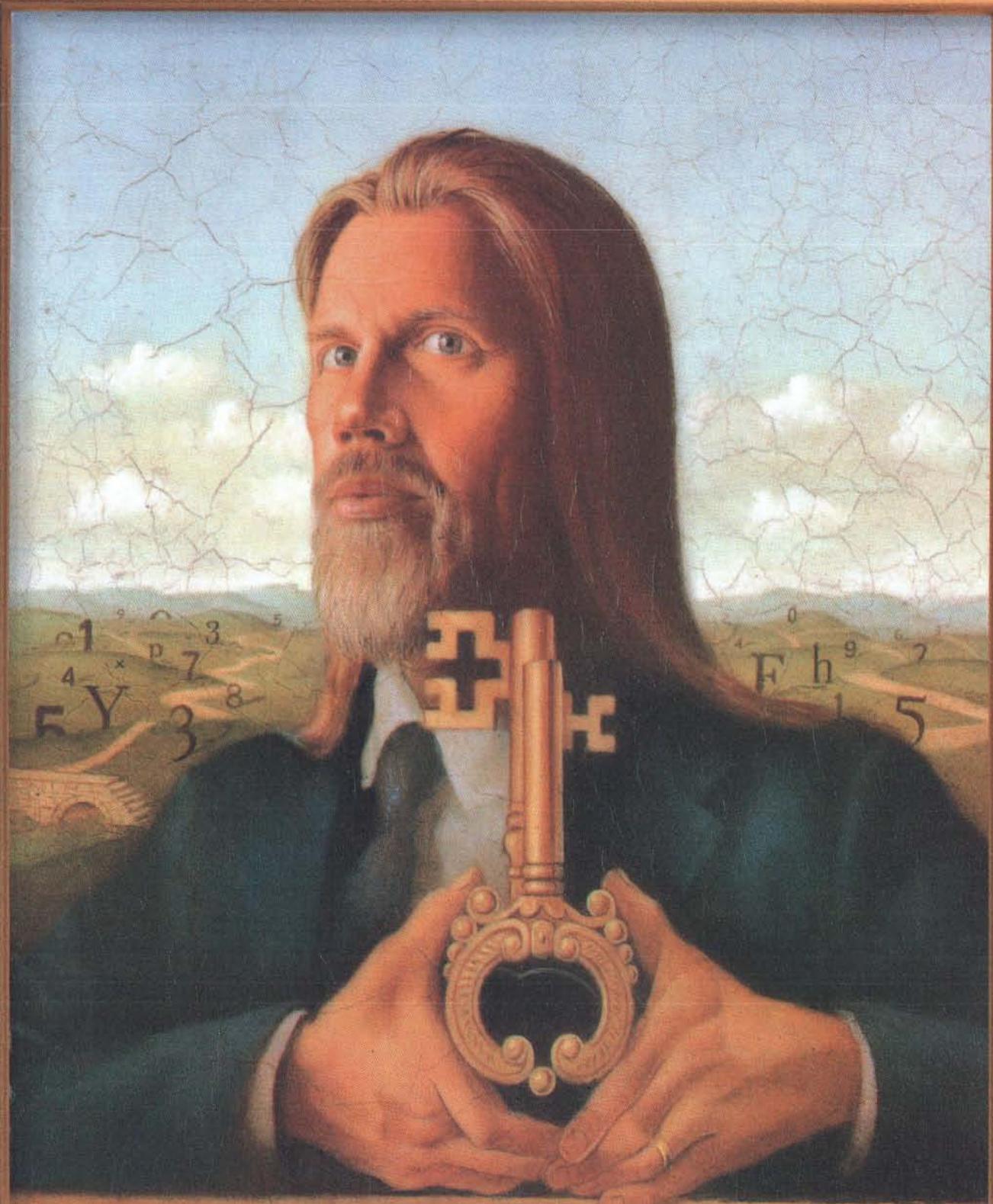
A helpful NSA employee shows Diffie and company to the latter. It's hardly different from any other vendor's operation at a high-tech convention – except that visitors must provide social security numbers and proof of US citizenship. The room is filled with several elaborate demos of cryptosystems running off PC nets. Diffie examines a system that allows several levels of encryption to coexist on a network. The young agency technician running the demo is obviously bright, perhaps even a bit haughty as he runs the system through its paces. As Diffie turns away, someone asks the technician if he recognized that bearded fellow.

"Who?" the technician asks.

"That's Whitfield Diffie. He invented public key cryptography."

The technician's eyes widen to the size of video monitors. For a second he is paralyzed. Then he bolts forward. "Dr. Dif-fffffie..." he shouts, "Dr. Dif-feeeeeee..." When he catches up, his attempt to describe his awe comes out in a jumble. For a moment it looks like

Steven Levy (steven@echonyc.com) is a Fellow at the Freedom Forum Media Studies Center. He is author of *Hackers*, *Insanely Great*, and other books.



W H I T F I E L D D I F F I E

PAINTING BY ROB DAY

he might outstretch his arms and execute knee-bend bows, à la Wayne and Garth: "I'm not worthy!"

It was in 1976 that Diffie and Stanford University electrical engineering professor Martin Hellman blew open the cryptographic world by announcing a new way to protect secrets: the public key. It was a profound discovery; historian David Kahn (still in tow as Diffie leaves the booth) called it "the most revolutionary new concept in the field since the Renaissance." A pursuit formerly limited to the domain of spies, diplomats, and the military now had the potential to enhance the privacy of the masses. Public key has the potential to change the way we work, even the way we live.

Compared to ordinary encryption, public key is a type of magic. By splitting the scrambling-and-descrambling "key" into two components, a widely distributed public key and a closely held private key, it enables users to communicate in complete secrecy with people they've never met. And when that person replies, only the user will be able to read that message. Even more remarkable, it makes possible a "digital signature," assuring that an electronic message was generated by the person who claims responsibility for it. Together, these features allow us to create new forms of digital commerce with an unprecedented level of privacy. These possibilities also present a challenge to government, particularly to the NSA, which is accustomed to controlling the nation's cryptosystems. As cryptography slips into the mainstream, the agency is faced with a dramatic reassessment of its mission.

And looking over the agency's shoulder is Whit Diffie, who has emerged as a passionate and public critic of government cryptographic policy. His eloquence alone would make him a formidable figure in the debate over whether the feds should limit the spread of crypto, but his credentials make him a figure truly to be reckoned with. "I would say he is the elder statesman of cryptography," says Jim Bidzos, president of RSA Data Security. "Few people have the kind of insights he does."

Yet at one time, it looked like Diffie might slip into obscurity as an eccentric hacker who never made much of his genius for math and his laser-focus mind. As his wife tells it, on the very eve of the historic discovery of public key crypto, Diffie was virtually despondent. "He was telling me that he should do something else," recalls Mary Fischer, "that he was a broken-down researcher."

This was 1975. Diffie was 31, with only a bachelor's degree, and he had reached a point in life where, he says, "I was worried that I wasn't particularly remarkable as a programmer and that my lot in life would get progressively worse if things continued going as they were." All his life Diffie had jiggled in perfect cadence to an internal tune, heeding little of convention. Had the music led him to a dead end?

Whit Diffie, it seems, had always been different. Born in 1944, he was the sole offspring of Bailey Wallace Diffie and Justine Louise Whitfield. They had met as foreign service workers in Madrid in the 1920s and married in Paris in 1928. Diffie senior became a City College of New York history professor specializing in Iberia and its colonies, and Whit grew up in Queens, in perhaps the only atheist Camelite household in

a mostly Jewish neighborhood. "One of Whit's oldest friends told me he had an alternative lifestyle at age 5," says Mary Fischer.

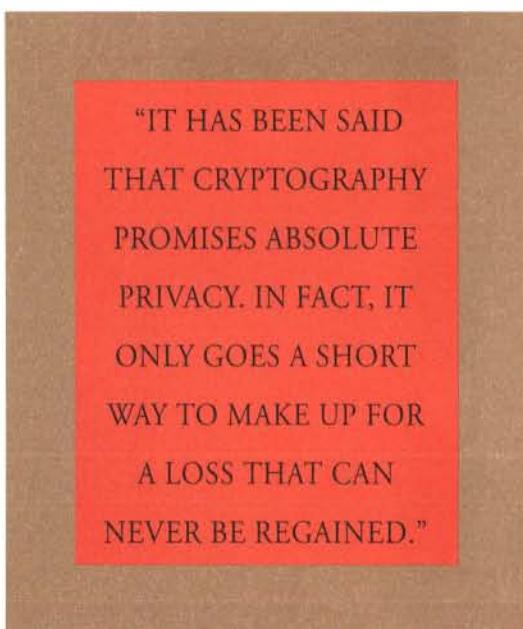
Diffie didn't learn to read until he was 10 years old. There was no question of disability; it was obvious he was a bright, curious child. He simply didn't read, and no one considered it a horrible problem. During the fifth grade he spontaneously worked his way through a tome called *The Space Cat* and immediately progressed to one of the *Wizard of Oz* books. Later that year, his teacher at PS 78 — "Her name was Mary E. Collins and if she is still alive I would like to find her," says Diffie — spent an afternoon on the subject of ciphers, and Diffie was so taken he had his father check out all the cryptography books in the City College library. But his code mania soon faded, and he pursued other interests — castles, camouflage rockets, and poison gases. (As late as his junior year in high school, he considered a career in the military.) Diffie also became interested in math — "I thought of myself as a mathematician in high school," he says.

At the Massachusetts Institute of Technology, he harbored contempt for computers — he thought himself too pure a mathematician to have much truck with them. This began to change after he earned his degree in 1965. The Vietnam War damped Diffie's military enthusiasm, and he became a self-described "peacenik," with no desire to deploy the armed rockets and poison gases that had entranced him in his youth. Like many, he found a way to avoid the draft — working for a defense contractor. It was the Mitre Corporation, a Massachusetts systems engineering company that worked for the Defense Department. The job was a plum — while technically a Mitre employee, he would write LISP code at the MIT Artificial Intelligence Lab. There Diffie was exposed to the best computer hackers in the world. By the time he left Mitre in 1969, Diffie was over his contempt for computers.

Ever since his freshman year at MIT, though, when he spent the summer in Berkeley, Diffie had been pining to move west. "I hung out with the red diaper set in New York, the frontier of the sexual revolution. I'd been used to having a full social life — folk singing parties and stuff like that. There were such scenes in Cambridge, but I fell in with what was easy: hanging out with these guys at MIT's East Campus — with 25 women in a class of 950, it was a Boy Scout camp. But when I went back to Berkeley, immediately I was in among what I thought of as the real people. I have always believed the thesis that one's politics and the character of one's intellectual work are inseparable."

Diffie got his chance to go west when he heard that artificial intelligence pioneer John McCarthy was interested in a mathematical problem that fascinated Diffie: proof of correctness of programs. Diffie was hired to work at Stanford's Artificial Intelligence Lab, where McCarthy was a professor. But he now conjectures, "In his view, McCarthy probably hired me as the LISP system programmer." Nonetheless, Diffie's work in proof of correctness (funded, ironically, by the NSA) apparently met with McCarthy's approval. Then McCarthy, in essence, lost Diffie as a worker by urging him to consider crypto once more. Diffie's long-dormant penchant for cryptography was quickly rekindled, and he began working on crypto obsessively.

There are several reasons that cryptography so entranced Diffie. He has always had a visceral interest in personal privacy. Though he



prefers not to label them as such – after trying several labels to characterize his views, Diffie finally decided none applied – his politics are strongly libertarian. There was also the challenge of investigating a problem that was, in a sense, forbidden. “It was a whole secret field,” he says. “Ostensibly my reason for getting interested in it was that I thought it was important to personal privacy. It seems to me now that I was also fascinated with investigating this business that people wouldn’t tell you about. But it was unlike a lot of other secret things where it was very, very hard to get at real evidence because somebody else had control of the information and you had to try to get informants or something like that. With cryptography, there was a certain amount of solid information one could figure out merely by doing mathematics.”

Finally, there was Diffie’s personal quest – his belief that solving the problems of crypto would provide some meaning to things. “I think somewhere deep in my mind is the notion that if I could just learn the right thing I would be saved,” Diffie says, laughing at his own struggles. “So I’ve been looking all my life for some great mystery. And this is the most successful one I’ve investigated. I mean, I certainly feel the lure of things that are in some way mysterious. I felt that if I could just get to the bottom of this it would somehow be incredibly satisfying.”

Diffie poured over David Kahn’s 1,164-page 1967 opus, *The Code-breakers*. “It must have taken me a year to read it,” he says. “I read it more carefully probably than anyone had ever read it. It’s like the Veda – in India if a man loses his cow, he looks for it in the Veda. In any event, by the spring of 1973, I was doing nothing but cryptography.”

Diffie took a leave from the AI lab and embarked on an epic sojourn to discover cryptographic truths. It was a lonely quest. True, NSA headquarters at Fort Meade, Maryland, was teeming with people working on these problems, but all the results were classified. Precious little information about the subject existed in the public domain. If someone did publish something, or try to patent a cryptographic innovation, the agency might attempt to classify that information. “My attitude was to keep my head down at first,” says Diffie.

For two years, Diffie crisscrossed the country in a Datsun 510. He hit every library that might have some information and attempted to talk to anyone whose ideas might inform his own. Some people refused to talk to him. But the journey helped in establishing the key problems Diffie needed to tackle in cryptography. (Besides, the trip wasn’t all cryptography: he managed to take in several Skylab launches and, most significantly, to hook up with Fischer, who became his traveling companion.)

When Diffie and Fischer finally returned to the West Coast in the fall of 1974, Diffie heard about a Stanford prof named Martin Hellman who was also interested in crypto. Diffie gave him a call; Hellman agreed to a half-hour meeting.

“There was an immediate meeting of the minds,” Hellman recalls. “I’d been working in a vacuum and getting disappointed and wondering whether it was really worth it. So meeting Whit was just fantastic. He had some ideas I’d already had and vice versa, and we each had some ideas that were different, and it was just an interplay.” The half-hour meeting lasted the rest of the afternoon, moved to Hellman’s house, and didn’t break up until late at night.

Hellman and Diffie agreed that Hellman would hire Diffie as a research programmer, and Diffie would eventually enroll as a Stanford graduate student – but in truth they were collaborators. (Diffie, who describes himself as incapable of working on anything that doesn’t interest him, never took his formal graduate studies seriously and eventually dropped out of the program. It was not until 1992 that he received a doctorate from the Swiss Federal Institute of Tech-

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CYPHER WARS

Pretty Good Privacy Gets Pretty Legal

By Simson L. Garfinkel

No matter who’s involved, public key encryption never fails to create its own controversy. While the US Congress and the National Security Agency duke it out with folks like Whit Diffie over where to draw the bounds of privacy, two of the leading figures in the encryption movement have been locked in a grudge fight over who has the right to provide public key protection to the masses.

It all comes down to a fight over Phil Zimmermann’s program called Pretty Good Privacy, or PGP. Combining Diffie’s concepts with patented algorithms that implement those concepts, Zimmermann created a personal computer-based program that renders files and electronic mail almost spy-proof. He then gave it away free. All well and good, except for one minor point: those patented algorithms had already been licensed to RSA Data Security Inc., which has no intention of letting Zimmermann corrode its markets.

In PGP’s documentation, Zimmermann called his program “guerrilla freeware.” Jim Bidzos, president of RSA and its sublicensee Public Key Partners, has called Zimmermann “an intellectual property thief. He offered to give away something that wasn’t his to give.” The 39-year-old Bidzos, a burly Greek national, could easily pass for a Hollywood version of an arms dealer – and that’s how he’s categorized under US law, which classifies cryptographic software as “munitions” and forbids its export.

Since its free release into the Net world in June 1991,

PGP has become the bane of law enforcement officials, who say it lets criminals and would-be terrorists hide the evidence of their illegal activities.

Recent, stronger versions of PGP have emboldened a new generation of civil libertarians and self-proclaimed cypherpunks, who say that strong cryptography is a fundamental requirement for free speech among law-abiding citizens in the electronic age.

Perhaps so. But, free speech or no, anybody who used early versions of PGP in the United States could be sued – not for trying to protect their privacy, but for patent infringement. The patent for the basic algorithm at the heart of PGP – the RSA public key encryption algorithm – is assigned to MIT, which has licensed it exclusively to RSA Data Security.

Unless you have a license, you can’t distribute an invention based on someone else’s patent, and Phil Zimmermann, PGP’s 40-year-old author, didn’t have one. But he gave away the software anyway, by passing it out on floppy disks to other people who, in turn, made it available for download on bulletin board systems around the Net. (For more on how Zimmermann created PGP, see “Crypto Rebels,” *Wired* 1.2, page 54.)

Quick-tempered and unshakable in the belief that RSA Data Security is fighting the holy war to bring cryptography to the world, Bidzos has nevertheless tried to block PGP at every possible opportunity. Bidzos pressured online services like CompuServe and America Online to take copies of PGP off their systems. 165 ▶

SOME

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OF A

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THE REST

OF US

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So, you want a perfect game. Get Hardball 4. Get cutting-edge graphics that are incredibly real. We're talking about wake-the-neighbors-and-call-your-friends kind of real. Get stat compilation that would make any sports bureau envious. Get all 28 stadiums with different altitude, field, and wind conditions. Throw in an add-on disk with over 700 major league players. And you've got a masterful gem that compelled *Computer Entertainment News* to label it One of 1994's Ten Best Games. Now, to get a perfect game you don't have to be in the zone. Just the right software store.

HARDBALL 4
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How Buildings Learn

Cinemania '94

I am desperate for a CD-ROM that is half as good as a book. Microsoft's *Cinemania '94* is half as good as three books. Scheduled to be updated every year, *Cinemania '94* combines the work of three prolific movie reviewers: Leonard Maltin, Roger Ebert, and Pauline Kael. Better make that four books, because this CD-ROM also includes background material from the *Film Encyclopedia*. All this text is intelligently cross-linked, just as you hoped it would be.

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—Kevin Kelly

Cinemania '94: US\$59.95.
Microsoft Corporation: (800) 426 9400, +1 (206) 882 8080.

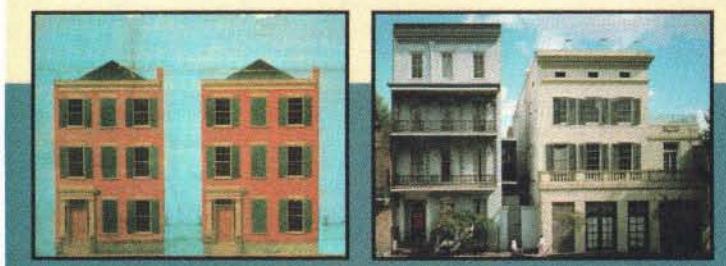
A stunning exploration of the design of design, Stewart Brand's *How Buildings Learn* will irrevocably alter your sense of place, space, and the artifacts that shape them.

While writing a book about the Media Lab at MIT, Brand became curious – then fascinated – by the contrast between the impractical, awful, sleek I.M. Pei-designed Media Lab building he worked in and the lovable, functional, ugly Building 20 (a “temporary” structure built in WWII that stands nearby). Comparing the Media Lab, known formally as the Wiesner Building, with Building 20 prompted him to explore what makes buildings successful.

Brand brings his software sensibilities to the hard environments of building construction. He embraces upgrading, modularity, maintenance, and user manipulation as essential to creating precocious buildings. He also finds inspiration in the works of Christopher Alexander, a professor at the University of California at Berkeley whose *The Timeless Way of Building* and *A Pattern Language* articulate the kind of organic, evolution-

HOW BUILDINGS LEARN

What happens after they're built



STEWART BRAND
DESIGNED BY THE WHOLE EARTH CATALOG

What happens when a building takes on a life of its own?

any approach to architecture that *How Buildings Learn* so admires. Brand wants buildings to be a medium of design for the people who live and work in them. As he puts it, “Evolutionary design is healthier than visionary design.”

How Buildings Learn is beautifully crafted, smoothly written, filled with pithy aphorisms (“Function Melts Form”), and elegantly illustrated with sketches and photographs of buildings evolving. With a touch of ingenuity, this could be a brilliant CD-ROM or Hypercard stack.

Brand's *Whole Earth Catalogs* and *The Media Lab* each captured a moment in time. But *How Buildings Learn* will endure as long as the buildings it describes. Of course, *How Buildings Learn* is a misnomer: this is really a book about how people learn. Yes, they tend to learn the hard way. But the mistakes they make can be illuminating.

Besides, how can anyone dislike a book about buildings by someone who lives in a renovated tugboat? —Michael Schrage

How Buildings Learn, by Stewart Brand, US\$30. Viking: (800) 253 6476, +1 (212) 366 2229.





The Lawn Ranger

If the Jetsons had a little kidney-shaped patch of grass floating next to their skyscraper condo, the Weed Eater Robotic Solar Mower would be right at home grooming it. Looking like an oversized solar-powered horseshoe crab, the 12.5-pound mower runs continuously on 34 solar cells, nibbling away at any lawn throughout the day. It has an on-board computer and guidance system that keeps it on course. A safety cut-off and a buried yard perimeter wire prevent the mower from going berserk, tearing off through the neighborhood and running over the



Mows while you snooze.
poodle next door.

And the little grass whacker will be safe from neighborhood swipers: a password is required to get started or to move it off the lawn. It will squeal like a pig if an unauthorized person touches it.

When I posted on the Net, looking for information on this device, it was as if I had tapped into some suburban zeitgeist: people waxed poetic about how much sweat and time they could save. — Gareth Branwyn

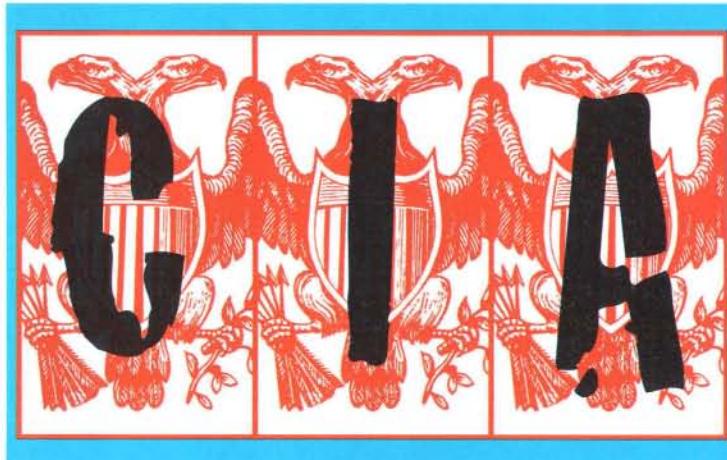
Robotic Solar Mower: US\$1,995, including boundary wire installation and solar generator. Poulan/Weed Eater: (800) 554 6723, +1 (318) 687 0100.

Spook Busters

Back in the '60s, the CIA and other crew-cut crusaders for mom and apple pie kept close tabs on subversives. Trouble was, no one was watching the boys in trench coats. Now it's easy to do a little counterspying of your own, with *CIABASE*, an 8-Mbyte database of CIA deeds, duds, and dirty work, culled from more than 850 public sources — books, congressional reports, newspapers, and magazines.

CIABASE is the brainchild of Ralph McGehee, a retired Central Intelligence Agency operations officer and one of the agency's sharper critics. Just load McGehee's program onto your Mac or PC and start snooping — by keywords, dates, or any of more than 100 categories, such as "assassinations," "blackmail," "media," "psywar," "sex," or "electronic surveillance."

A search of the "mind control" category yields 150 hits, including wacky CIA experiments during the mid-'60s: "Apes were then decapitated and heads were transferred to another body to see if energy from radio fre-



The CIA: intelligence gatherers or dadaist pranksters looking for a good time?

quency could revive animals." There is also plenty of data on monkey business with human guinea pigs, including "experiments designed to influence brain waves with remote-control electrical devices" and operation "Midnight Climax," in which prostitutes lured unsuspecting johns to a CIA bordello in San Francisco and dosed them with LSD as researchers "studied" the results from behind a two-way mirror. (McGehee's brief abstracts lead you to the original source material.)

The CIA's vintage '60s, Rube Goldbergian assassination technologies are also laid out in all their hairbrained glory, including the famous failed plots to ice Castro, using the mob, poisoned stogies, exploding sea shells, and — my personal favorite — a scheme to convince island Catholics that Fidel was the antichrist.

CIABASE covers much more than wacky arcana, though, and frequent updates keep the data topical: recent entries cover the Aldrich Ames spying scandal as well as the Clipper Chip. — John Whalen

CIABASE for Mac or PC: US\$199, updates: US\$99 each. Ralph McGehee: +1 (703) 437 8487, e-mail ralphm1020@aol.com.

No-Brainer Booklets

It's possible to use desktop publishing software to produce a booklet, but whenever I try, I goof when it comes to guessing which pages go upside-down next to the other pages and how to orient the paper in the laser printer. I end up pulling out the scissors and a pot of half-cured rubber cement and finishing the thing the old-fashioned way, with the old-fashioned results: crooked, misaligned text.

But ClickBook software makes booklet production basically brainless. Just go through the usual steps of printing a file from whatever application you happen to be using (word processor, database, spreadsheet), and the ClickBook dialog box will pop up on the screen. Then select the size of the booklet you want (from ridiculously itsy-bitsy to half-page), and, Presto! Your printer spits out the pages, along with an instruction sheet explaining how to put the paper back in the printer for printing on the other side. The hardest part is assembling the finished product from the printed pages. ClickBook could



ClickBook: spread your memes with style.

have done a better job of indicating which lines needed to be folded and which needed to be cut. I had to resort to reading the instruction manual to get it right.

One snag bookleteers run into is binding their mini-magnum opuses. Standard office staplers don't have the reach for larger booklets. But the ClickBook package comes with an order form for long-reach and saddle staplers that'll make this part of the process a snap. One of these staplers will set you back at least 50 bucks, but you'll be happy you bought one when you discover how difficult it is to get the job done without it.

Also thrown into the ClickBook package: the Paper Direct specialty paper catalog, so you can make your booklet look snazzy.

This is neat — instant books! Now all you need to do is come up with something interesting to put in them. — Mark Frauenfelder

ClickBook for Mac and Windows: US\$69.95. BookMaker Corporation: (800) 766 8531, +1 (415) 354 8161, fax +1 (408) 655 6071.

Gadget

During my wonder years, I fantasized about a vehicle that could burrow, mole-like, underground. It could also navigate underwater, cruise the ocean's surface, and – naturally – fly. Two-thirds of the way through *Gadget*, Haruhiko Shono's latest epic CD-ROM, I saw my childhood dream machine. In *Gadget*, the Ark is either a prototype pod to escape earth's impending collision with a comet, or a hallucination in a macabre mind-control experiment called Sensorama.

Most of *Gadget*'s action takes place aboard a train – and in train stations – where



The bellhop from hell.

you click your cursor over cadaverous figures who range from escaped mental patients to Messianic scientists. As with all of Shono's work, the production values are high, with evocative sound and fabulous visuals.

Though *Gadget* spends a bit too much time shuttling back and forth on trains, much of this adventure – particularly its climax – is riveting and spooky.

– Jim Metzner

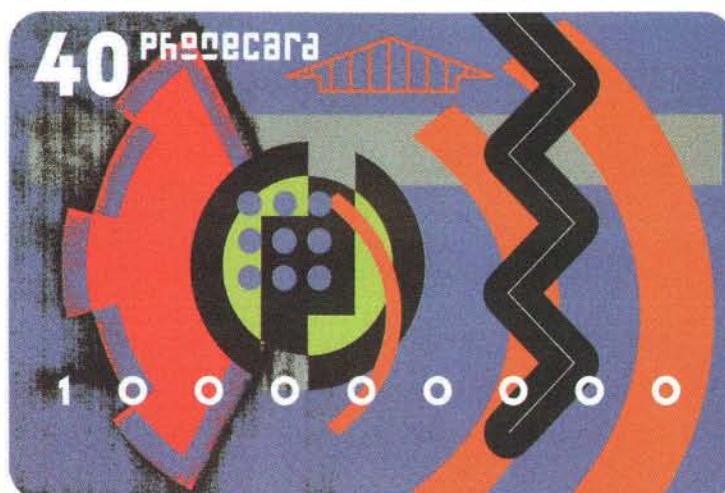
Gadget for Mac and Windows: \$9,800 (US\$79.99). Synergy Inc.: fax +81 (3) 5272 9610. Books Nippan: (800) 427 6100, +1 (213) 891 9636, fax +1 (213) 891 9631, e-mail nippan@netcom.com.

The Graphic Language of Neville Brody 2

Flip through *The Graphic Language of Neville Brody 2* and you'll feel like you're channel surfing through the last decade of graphic design.

Brody's typographical pyrotechnics, reproduced in color on every page, are both familiar and avant-garde. Although groovy Brody-designed fonts such as FF Blur have been used by designers in just about everything from annual reports to music videos, seeing them deftly manipulated by Brody's own hand (or mouse), is like seeing them again for the first time. They move beyond the threshold of cool. Here, in the context for which they were created, they make sense.

Brody's design career began in London during the late '70s, where the catalyst for his first work – mostly album covers and fanzines – was the city's burgeoning punk scene. He moved on to become the art director of such acclaimed British magazines as *The Face* and *Arena*. By 1987, Brody had founded his own studio. While the first volume, *The Graphic Language of Neville Brody*, documented Brody's evolution from art student to Britain's most renowned graphic designer, this sequel chroni-



Neville Brody 2: like channel surfing through the last decade of graphic design.

cles Brody's exploration of the personal computer as an integral aspect of the design process.

Author Jon Wozencroft, Brody's collaborator and a force in the founding of the Brody Studio, introduces the new work by describing "a social revolution in communications," namely that of the shift "from analog to digital" technology. The computer's influence on design is hardly news anymore, but the eclecticism it has injected into Brody's visual lexicon may surprise you. On one page there's the "bad boy" Brody – distorting and layering text, stretching the boundaries of legibility. On the next page, a magazine spread is a paradigm of Spartan clarity.

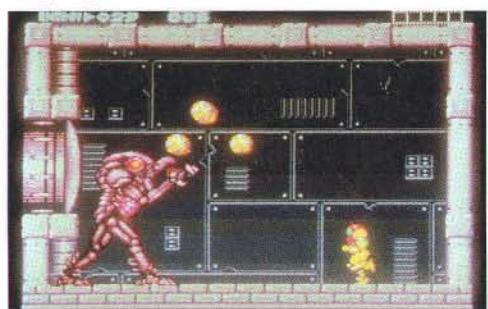
Chaotic and elegant, these images are guaranteed to thrill. Wozencroft's text, however, is peppered with enough pretentious sentences to satisfy any overeducated semiotician. ("The way forward is being located around a homeopathic strategy of confronting like with like." Huh?) As with most books in this genre, you'll want to look at the pictures more than you'll want to read the words. And why shouldn't you? Brody's design speaks for itself. Besides, words are the pictures. – Steven Overman

The Graphic Language of Neville Brody 2, by Jon Wozencroft, US\$45. Rizzoli International Publications Inc.: +1 (212) 387 3400.

Femme Fatale Fantastico

Super Metroid is not only the most digitally dense Super Nintendo Entertainment System cartridge ever, it is by far the most compelling – even if it did steal its premise from the *Alien* trilogy. But, compared with *Super Metroid*, the actual *Alien* cartridge plays like *Pac Man*. Packed with 24 Mbytes of solid-state, side-scrolling action, *Super Metroid* puts you in the role of heroine Samus Aran, space bounty hunter. Mission: infiltrate planet Zebes and wipe out the Metroids – a pack of deliciously creepy mutants holding the place hostage. The story line here is pretty well worn, but so what – it's a blast!

With five huge realms to explore, the real fun lies in hunting for personal arsenal resources like the morphing ball, which transforms Samus into a



Super Metroid: this *Alien* clone's better than the real thing.

polyp-like orb that exudes a trail of exploding goop in its wake. Other helpful techno-props include a full-screen map that shows where you've been so far, plus jack-in map pods and a helmet-mounted X-ray scope for lighting up map sights previously unseen. Joypad control is ultrasMOOTH and responsive, with easy to master button-assignments for quick weapon changes, inventory, and map checking.

The game is brilliantly rendered in throbbing, iridescent tones and textures: given the game's eerie background score, the whole experience achieves a down-and-steamy-hunt-for-your-life feeling that's the tastiest excursion I've enjoyed in a long time.

– Joe Hutske

Super Metroid for SNES: US\$59.95. Nintendo of America: (800) 255 3700, +1 (206) 882 2040.



False Lies

If ever there was an aptly named book, this is it. In a highly readable and sincere manner, *Nothing in This Book Is True, But It's Exactly How Things Are* proceeds to thread together every New Age belief and conspiracy theory into a grand unified field theory of kookiness. They're all here: gray aliens, ascended masters, free energy, angels, cattle mutilations, crop circles, rebirthing, earth changes, the Great Pyramid, Sirius, and secret colonies on Mars. And yet, despite the sheer unbelievability of half the book, the author's goodwill and spiritual intentions are so infectious

BOB FRISSELL

Nothing in This Book Is True, But It's Exactly How Things Are



The '90s Cosmic Trigger.

that the book ends up being a heartwarming experience.

Nothing's main drawback is its somewhat rudimentary literary style. But a lack of stylistic niceties have never stood in the way of a good yarn becoming popular, and this yarn is a great one.

Nothing has the potential to become the *Cosmic Trigger* (Robert Anton Wilson's 1977 psychedelic mind-bender) of the '90s.

—Jay Kinney

Nothing in This Book Is True, But It's Exactly How Things Are, by Bob Frissell, US\$12.95. Frog Ltd.: (800) 559 8337, +1 (510) 559 8277.

Robinson Crusoe on Mars

Science fiction films of the early '60s were often bursting with the comes-under-the-bed-nuclear-nightmare ethos of the time. Consider such epics of paranoia as *The Earth Dies Screaming* and *Village of the Damned*. One 1964 film, however, stands apart from the others, both in ambition and point of view.

Robinson Crusoe on Mars (aside from being saddled with one of the worst movie titles of all time) captures the optimistic side of the Space Age. Just like the original Defoe tale, *Robinson Crusoe on Mars* is the story of a voyager who finds himself marooned far from home and must create a new life for himself. In this version, the voyager, astronaut Christopher "Kit" Draper, triumphs over his environment through a combination of will and luck. Draper is not only endlessly resourceful, but endlessly driven to survive and work. He ends up not only finding a way to live and breathe in the thin Martian atmosphere, but also becoming a hero by



A movie about man and monkey marooned on Mars. Now that's entertainment!

rescuing Friday from alien slavers. *Robinson Crusoe on Mars* is an undiluted and unselfconscious hymn to American ingenuity and the best Jimmy Stewart/Frank Capra impulses of fairness and equality. It also has some beautifully evocative moments of alien weirdness: spaceships flitting around like insects, the burning surface of Mars.

As usual, this Criterion Collection disc from Voyager contains great supplementary material, including interviews with the principle actors and production team, the original film trailer, and production sketches and excerpts from the original illustrated script for the film. This last is especially fascinating, showing the huge ambition of the film (which originally included Friday as a three-fingered alien as well as encounters with weird Martian flora and fauna). It's a fine thing to be reminded occasionally not only of our lost optimism, but also of the ambitious science fiction cinema that predated *Terminator 2*, and even *2001*. —Richard Kadrey

Robinson Crusoe on Mars: US\$100. The Voyager Co.: (800) 446 2001, +1 (212) 431 5199.

Radio ASCII

Pagers have come a long way since the days when a beep sent you to the telephone to listen to a message. Pagers now receive notes of up to 240 characters, long enough for short e-mails, headline news feeds, and other up-to-the-minute content broadcasts.

Oakland, California-based Notable Technologies developed AirNote as an all-in-one solution to advanced paging. Notable is not actually a network operator itself: the company resells service on the SkyTel and PageNet national networks. Notable develops the communications software to provide numerous options for integrating pagers into your local e-mail system and packages it with a standard pager into a single box you can purchase for all your paging needs.

As with many of today's alphanumeric pagers, AirNote pagers come with an Internet address (*idnumber@airnote.net*). Additionally, AirNote provides a real name alias (*yourname@airnote.net*), and will also send a copy of all messages to another e-mail address of your choice. Windows users can



Clip the Net on your belt with the AirNote alphanumeric pager. run gateway software to forward messages out of many popular LAN e-mail packages to the pager. The more standard paging options (operator-assisted and TouchTone messaging, as well as voicemail notification pages) are all supported.

AirNote falls into the category of services better financed by your employer — coverage in one region (West, Midwest, etc.) plus 200 messages costs US\$109.95 per month. According to Notable Technologies, one message is equal to 40 characters, so a 240-character e-mail message counts as six. Each message above 200 costs 60 cents. Voicemail boxes and operator-assisted pages are extra.

Still, for the battle-hardened business traveler, pagers are a must-carry item, and AirNote has put together a well-integrated package of services to keep you connected. You'll realize just how connected you are when you're driving home and your spouse pages you with a grocery list of things to pick up on your way. "Sorry dear, I guess my batteries must have run out." —Andrew Anker

AirNote: US\$349. Notable Technologies Inc.: (800) 732 9900, +1 (510) 208 4400.

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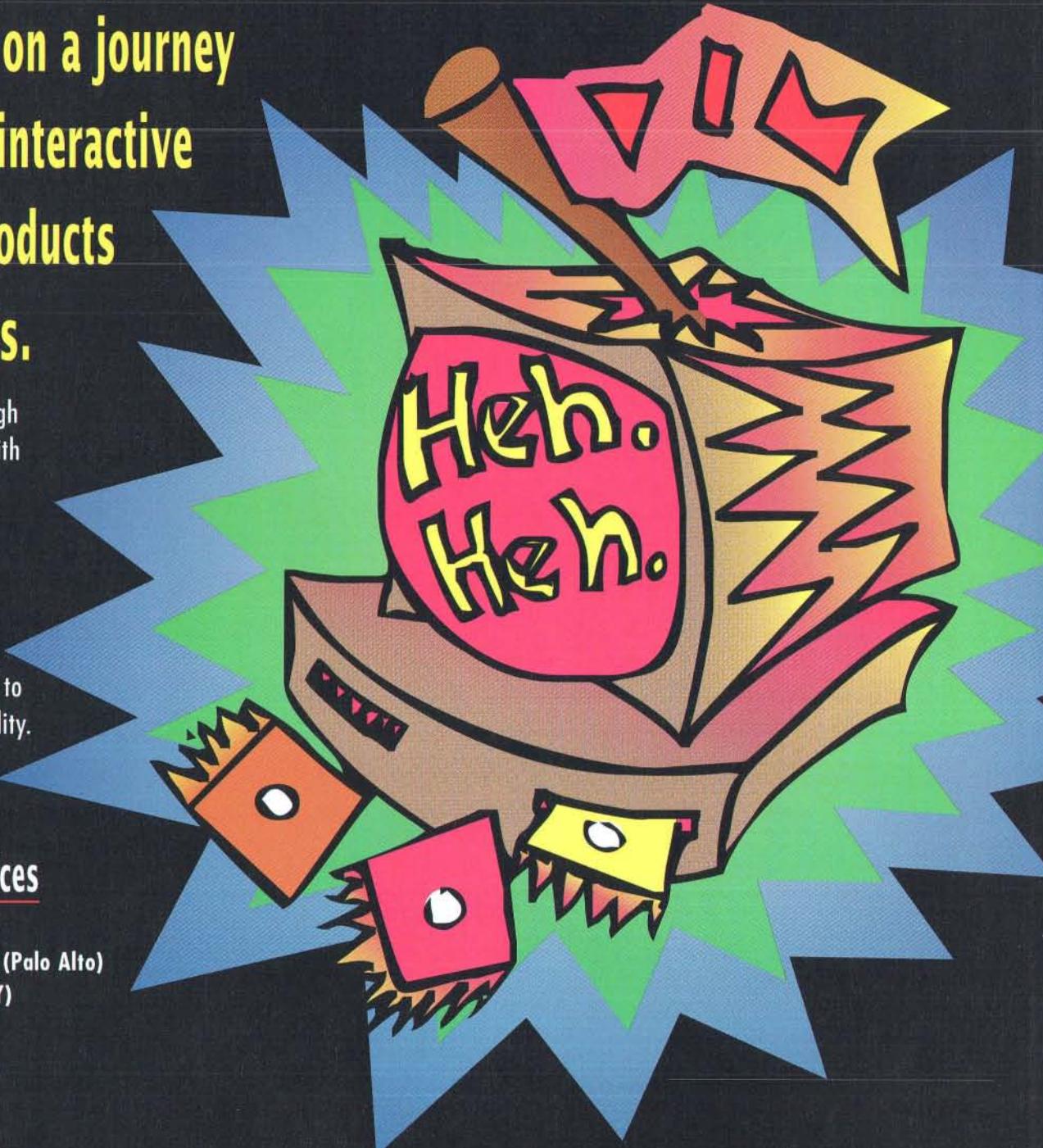
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They Might Be Giants

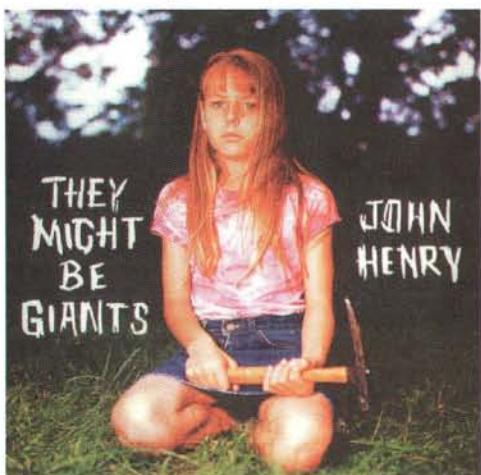
John Henry

Elektra Entertainment

Access Code 1219

We are a band that used to be a machine-oriented band; we've now evolved into an organic ... human being-driven ... band." Or so claim They Might Be Giants band members John Flansburgh and John Linnell. Once again, Flansburgh and Linnell – fortified by Tony Maimone, Kurt Hoffman, Steven Bernstein, Brian Doherty, and Frank London – have taken elements of pop's past and created an album with invariably catchy hooks, idiosyncratic lyrics, and consistently brilliant songwriting. The album runs the rock spectrum from the boasting "Extra Savoir Faire," through the secret-agent spoof "Spy," to the a cappella "O, Do Not Forsake Me."

The progression from machine-produced tunes to those born of living, breathing musicians has added



a dynamism to the music that is superb and tangible. Still completing each other's sentences, the Johns simultaneously explain, "The greatest relief is that I don't have to ... tweak the drum parts – there's another guy tweaking the drum parts for me."

Both "Sleeping In The Flowers" and "No One Knows My Plan" reveal, with the strains of sweet horn arrangements, an added dimension to the Giants's sound that simply could not have been accomplished with electronics. Similarly, the talents of Maimone and Doherty free Linnell and Flansburgh to concentrate on tweaking the songs, not the individual instrumental parts. "It's almost like we took the lineup of a 1966 show band," says Flansburgh, "and produced a whole record with them. There's a lot of Hammond B3 and these small horn arrangements, and that's really the sound of a very specific era of pop music." John Henry also seems to prove that science, in fact, cannot improve on nature. – Peter Herb

Ali Farka Toure with Ry Cooder

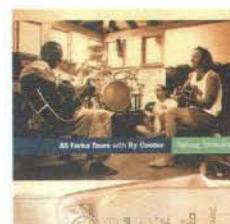
Talking Timbuktu

Rykodisc/World

Circuit/Hannibal

Access Code 1220

Getting from Mali to Mississippi and back again is as easy as catching a plane – or popping in this disc. Toure emerged from the West African Timbuktu region in the early '70s, packing a blues guitar blessed by John Lee Hooker himself. Ry Cooder, fresh from his Grammy-winning recording with V.M. Bhatt, produces and tastefully adds his own stringed prowess to this disc. The result is a true-to-form Toure recording that should make every Delta-blues, Ry Cooder, and African-guitar fan in the house very happy. – David Blank-Edelman



Locatelli: L' Arte del Violino

Elizabeth Wallfisch, violin, with the Raglan Baroque Players

Hyperion/Harmonia

Mundi USA

Access Code 1224

Like Paganini a century later, Baroque virtuoso Pietro Locatelli was a kind of rock star of his day. Sporting flamboyant dress and mannerisms, he commanded high fees for performances, dazzling one and all with his technical prowess. *L' Arte del Violino*, a set of 12 concertos with 24 virtuoso solo capriccios, raised violin technique to a new level and remains fiendishly difficult, even by today's standards. Early-music specialist Elizabeth Wallfisch, playing a period instrument, rises to the challenge superbly.

– Bryan Higgins

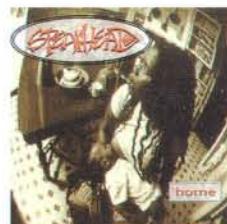
Barenaked Ladies

Maybe You Should Drive

Sire/Reprise Records

Access Code 1221

Maybe you should drive – right back to the music store to return this piece of dreck. It's difficult to believe this is product of the same talent that released *Gordon* in 1992. This 'Naked Ladies Lite – infantile lyrics and songs without taste – simply disappoints. I don't buy the excuse that these guys are simply not prolific or enduring. I suspect this sonic disaster is a result of record company pressure. I hope a future release – in "Naked Lady time" will once again demonstrate the talent so obvious on the previous album. – Katrina Holden



Spearhead

Home

Capitol Records

Access Code 1225

Disposable Heroes of Hiphoprisy's rapper revolutionary Michael Franti has a new team – Spearhead – and *Home* is Franti's ground zero after almost 10 years as a musician, poet, and all-around mover and shaker. More soul than industrial, more hope than spite, Franti and his energetic, talented crew take the sensual approach to getting your ass off the chair. Tracks like "Love Is Da Shit," "Hole in the Bucket," and "Runfaylife" are charged with influences ranging from Lin-ton Kwesi Johnson to Sly and the Family Stone. This is rich.

– Kristy O'Rell

Blues Traveler

four

A&M Records

Access Code 1222

With an expanded palette of moods and textures, these New York City jam fiends display a welcome evolution of their mix of jazzy undercurrents, bluesy vocals, rhythmic guitars, and sharp harmonica bursts. The guitars in "Stand" flow from funky to spacey, matching the downshifting tempo. "Fallible," a tender and sweeping ballad, is not the only tune on this disc featuring a gentle piano. But even though the disc shares the light tone of the group's début, and the last track is the old show favorite "Brother John," this album proves that the band ain't looking back. – Paul Semel



Mario Bauzá and the Afro-Cuban Jazz Orchestra

944 Columbus

Messidor/Roundworld

Access Code 1226

After living for 50 years on Manhattan's Upper West Side, "the man who created Afro-Cuban jazz" died last year, leaving behind the planet's cheeriest music. Song titles read like exotic postcards from Latin lovers: "Zambia," "Canto Lucumi," "Cubauzá." Besides mambos, sambas, and beautiful ballads, you'll find Berlin and Gillespie tunes, all served with conga line and the unmistakable aroma of rice and beans. Until you can legally fly to Havana, you're stuck combing ethnic record shops for Bauzá's spicy jazz – but, ¡pobrecito!, it's worth the hunt. – Colin Berry

Cabaret Voltaire

The Conversation

Instinct Records/

Access Code 1223

Sheffield's techno-prophets, the members of Cabaret Voltaire, have once again surfaced to preach their binary gospel. *The Conversation* marks the end of a brilliant trilogy, one that sounds more like covert murmuring than ecclesiastic din. This two-disc project bridges the acidic and ambient qualities of the first two installments; Richard Kirk and Stephen Mallinder do this seamlessly and with unmatched expertise. There are no industry buzzwords like "intelligent dance music" in their electronic vocabulary, just the ones and zeroes they have been building upon for decades. – Dan Sicko



Portishead

Dummy

Go! Discs/London Records

Access Code 1227

If ever the phrase "weird and wonderful" fit perfectly, it would be here. These are torch songs, '90s style. The music is cinematic, gritty, and sensual, with lazy hip hop beats and soulful stylings punctuating the mix. Imagine the sound of Sade on a bad trip, meshed with '60s spy-movie theme songs, and it may come close to *Dummy*. Portishead is defining the sound of dark-side soul and hip hop. At the heart of its work is a sound that's haunting and achingly beautiful. To hear is to understand. – Scott Taves

Microwave O' The Month

MICROWAVED CD: LISA SEAMAN



Paul Shaffer & The Party Boys of Rock 'N' Roll

The World's Most Dangerous Party

SBK Records

This party is "Dangerous" only to the frat-boy faves Shaffer *mashes*. I'd bill this one *The World's Most Flatulent CD*: a treat right up there with beer-farts and sleazy rug burns. Even Spinal Tap would be ashamed. — Kristin Spence •

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Code Artist and Title

- 1219 They Might Be Giants, *John Henry*
- 1220 Ali Farka Toure with Ry Cooder, *Talking Timbuktu*
- 1221 Barenaked Ladies, *Maybe You Should Drive*
- 1222 Blues Traveler, *four*
- 1223 Cabaret Votaire, *The Conversation*
- 1224 Locatelli: L'Arte del Violino, Elizabeth Wallfisch, violin, with the Raglan baroque Players
- 1225 Spearhead, *Home*
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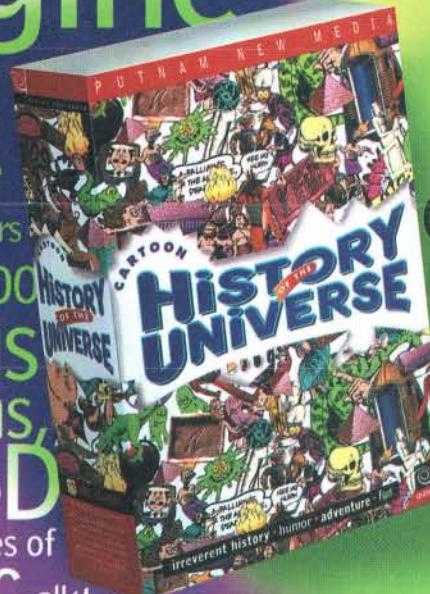
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Laser Loses

You may not have heard, but the police are carrying laser guns. Granted, these guns may not blast a hole in your fender, but they will zap your bank account: we're talking laser speed-monitoring guns. They're more accurate and more difficult to detect than radar-based monitoring guns. While laser detectors are available from several companies, K40 takes a different tack with its Defuser, a product designed to jam police laser guns.

Defuser packs an infrared emitter into an inconspicuous Lexan license-plate frame. The infrared light it emits is of the same wave-



Anti-laser ticket beater.

length as the laser gun's, making a reading impossible, according to K40.

While a radar detector is a passive device, the Defuser actively interferes with law enforcement. Since it operates in the light spectrum, not radio, K40 claims the defuser is outside Smokey's jurisdiction.

K40's guarantee: If you get a ticket from a laser-gun-toting cop, K40 will pay you twice the amount of the fine. But to keep it off your record, you'll have to go to traffic school yourself.

—Joe Weisenfelder

K40 Defuser: US\$199
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(800) 323 6768,
+1 (708) 888 7200.

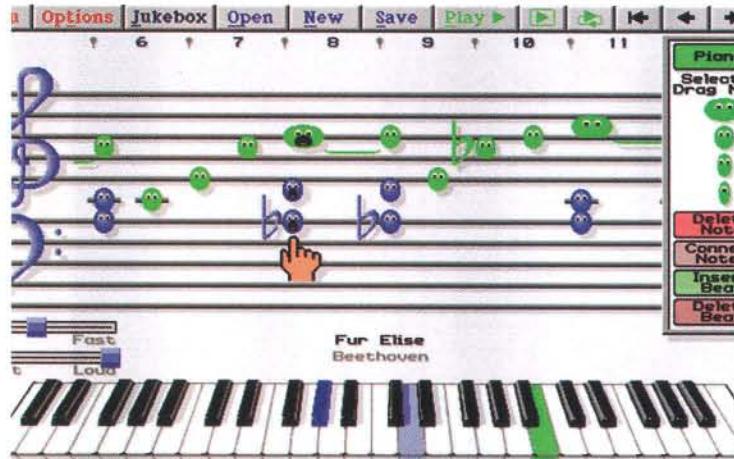
Music Ace

My parents would have saved bags of money had Music Ace software been around when my music lessons began. The program teaches kids the basics — note reading, pitch identification, and key signatures. So instructors can spend time on what's really important: helping students put all the pieces together and become musical.

Each of the 24 lessons in Music Ace includes a game that quizzes students on what they've learned. One game, for example, asks players to compare two pitches — represented by friendly-faced notes that "sing" — and decide whether the second is higher or lower than the first.

A student's good work earns plenty of positive reinforcement, such as bonus points or applause. Those who err can take another shot. "We tried to make it nonjudgmental," says Phil Rockenbach, one of the program's developers. "Students can proceed at their own pace and make mistakes in private, which takes some of the pressure off learning."

The program emphasizes ear training, which many beginning musi-



Music Ace: a patient and fun teacher that helps kids understand music.

cians are not exposed to, says Joel May, another developer. "They see a note on the page and just put their fingers where they're supposed to on the instrument. It's a mechanical thing. What should happen is you see a note, hear it in your head, then play it. Teaching ear training requires a lot of one-on-one instruction, and that's what the computer is good for."

Music Ace is supposed to have six instrument sounds to choose from, but I had a tough time hearing much difference. It's no big deal, though, especially in the face of really cool parts of the program like the Music Doodle Pad, which lets you compose and listen to your own music. You can also see and hear preloaded compositions by Bach, Mozart, and others, "improving" the pieces if you wish.

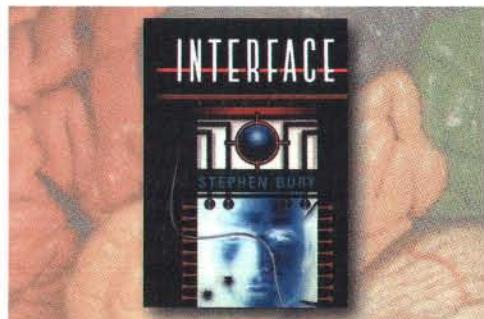
Many music software programs are boring, or lack a strong curriculum, or are too difficult for young students. Their developers should study this program. It works. —John Morkes

Music Ace for DOS: US\$59.95. Harmonic Vision Inc.: (800) 644 4994, +1 (708) 467 2395, fax +1 (708) 467 3008.

The Push-Button President

Interface arrived in stores by stealth. Its author, Stephen Bury, had never been heard of, and no biographical note appeared on the book. But fans of Neal Stephenson (see "Spew," *Wired* 2.10), whose fervid imagination gave us the cyber-operatic *Snow Crash*, weren't fooled — within days of the release they knew Bury was a pseudonym for Stephenson and J. Frederick George, who co-authored the novel. And instantly came the comparisons with the mind-bending, Pynchonesque *Crash*.

Verdict? *Interface* is, by *Crash* standards, fairly conventional, not even vaguely cyberpunk — its key link to techno-culture is a plot twist that has a stroke-hobbled presidential candidate revived by a silicon prosthesis that restores his brain functions but leaves him receptive to commands from the megapowerful conspiracy that developed the chip and linked it via radio to a focus group for real-time feedback. And students of the future of cyberspace will find nothing to equal the Metasphere of Stephenson's breakthrough tome. Yet by novelistic standards, *Interface* is probably a better book. The



characters are much more fully drawn, and in some cases quite memorable. The protagonist, Illinois Governor William Cozzano, is a powerfully likable stroke victim, but not a total goody-goody. His running mate is a feisty black woman who only a few years before was living in an automobile. But the most delicious characters are the colorful schemers, ranging from image makers to computer hackers, who engineer Cozzano's recovery and mastermind his campaign.

Interface is well plotted; its ingredients fall into place well enough to qualify it as a successful pot-boiler, though few of this genre can support a plot twist as outrageous as that concerning the poor fish whose cranium is a dress rehearsal for the operation on Cozzano's head. And few barn burners by Robert Ludlum, Stephen King, or Tom Clancy, would tempt you to close the book, walk up to a friend, and begin chanting (as a character in a memorable scene does), "Wubba wubba wubba wubba wubba." If you hear someone do this, you'll know where it came from. But to really get it, you'll have to read *Interface* yourself. —Steven Levy

Interface, by Stephen Bury, US\$12.95. Bantam/Spectra: +1 (708) 827 1111.

A Silly Noisy David Bowie

Will adults, even very stoned adults, really find a thrill in turning on and off David Bowie's lamp, listening to phony messages on his answering machine, or opening and closing his file cabinets? The *Jump* CD-ROM does not allow us to lick Bowie's boots, though we may click on an assortment of women's shoes. Our reward is giggling noises meant to suggest how much we are missing by not being a rock legend.

Those who thought the best part of *Hell Cab* was wandering the empty halls of the Empire State Building may feel like they've wandered into its basement,



Jump is junk.

listening to exactly the same elevator music while pacing institutional gray halls. It was Anton Chekhov who said that if you hang a rifle on the wall in the first chapter of a book, you have to make it go off by the second. Here's an update: if you put an elevator in an interactive work, what happens when you go up should differ from what happens when you go down.

In a way, this disc represents a maturing of the CD-ROM tradition: there's enough history now that we're beginning to see slickly produced titles whose every working concept is already a cliché. — Jim Gasperini

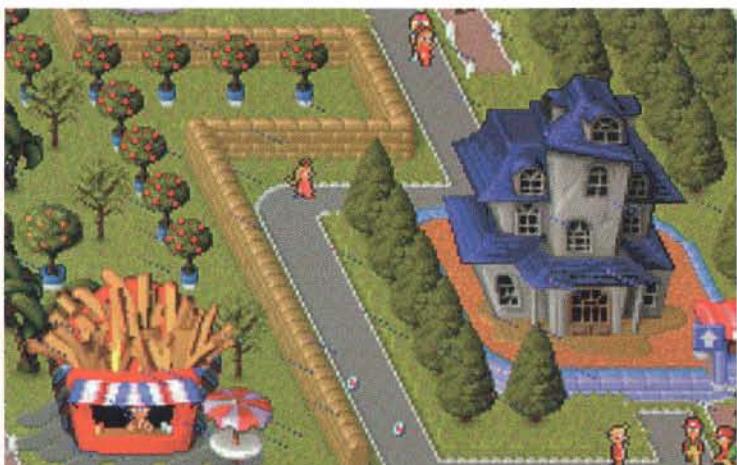
Jump for Mac: US\$49.95.
ION: +1 (310) 312 8060.

Variations on a Theme Park

For most folks, the word "bulldog" conjures up images of the slimy amphibian or the SPF eight-zillion sunblock. But for hard-core gamers, Bullfrog Productions Ltd. is the programming group responsible for a slew of classic "god" games: *Populous*, *PowerMonger*, and recently, the hyperviolent *Syndicate*. Bullfrog's newest release, *Theme Park*, is geared for more benevolent gods.

The first in Bullfrog's new Designer Series of simulations, *Theme Park* is a detailed sim of a theme park (duh). It features addictive gameplay — and graphics so cute you'll want to give your PC a great big hug. The 3DO version features a "rider's perspective" so you can see what it's like to ride in a one-quarter-mile-high roller coaster with corkscrews and loop-the-loops.

There are three difficulty levels you can choose from: "Sandbox," for the player who merely wants to build nausea-inducing thrill rides; "Sim," which introduces the complexities of money management; and "Full,"



Theme Park: the game that's as much fun to lose as it is to win.

which is the anal-retentive player's dream come true, giving complete control of everything from how much salt goes on the french fries to the color of the cutesy costumes worn by park employees.

It'll take more than just building and managing the mother of all theme parks to be successful in this game. You've also got to try to keep 40 other theme park owners around the world from buying up shares of your company and taking it over.

My favorite aspect of *Theme Park* is watching the ways the park goes to hell. Put the snack stands next to the rides and watch your patrons puke their guts out; fail to hire enough security guards and watch your park become a playground for gangs; fire the mechanics and watch your rides burst into flames, then blow up real good. How can you not like a game that's as much fun to lose as it is to win? — Zach Meston

Theme Park for Mac, PC, SNES, and 3DO: US\$59.95. Electronic Arts: (800) 245 4525, +1 (415) 571 7171. Nintendo of America: (800) 255 3700, +1 (206) 882 2040.

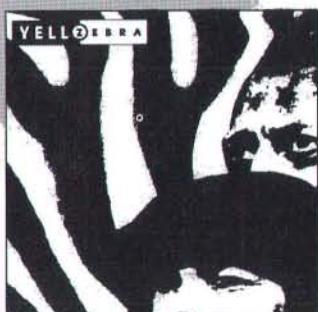
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1. Return of VR

Virtual reality is the hula hoop of high technology, exploding on the scene every few years only to be destroyed by its own hype. Three years ago, articles describing VR as the most important invention since fire and portraying Jaron Lanier as the new Thomas Edison were commonplace. However, as so-called VR systems hit the arcades and shopping malls, people quickly discovered that viewing fuzzy polygons resembles a bad hangover more than it does a new kind of LSD. But I predict a revival. In the last month a resurgence of interest in VR has accompanied significant improvements in 3-D graphics technology. Welcome back to the hype list, VR.

2. "Death" of Clipper

Some computer and privacy advocates have seized on the Clinton administration's recent hints of compromise on the Clipper Chip as a victory—an example of the executive branch bowing to the almighty wrath of the Net. But others see Al Gore's statements as meaningless—conceding little and avoiding the important issues. Some of these latter activists are now accusing the Electronic Frontier Foundation (which was quick to claim victory) of becoming, in *The Wall Street Journal's* words, "an industry lobbying group"—interested in achieving only the short-term goals of Apple and AT&T. If the administration is smart, it will continue to hint at limited, and divisive, concessions.

	Current Position	Position Last Month	Months on List
Return of VR	1	-	1
"Death" of Clipper	2	-	1
Post-Ambient	3	-	1
New Operating Systems	4	3	2
Mighty Morphin' Power Rangers	5	-	1



3. Post-Ambient

Most musical genres rapidly divide, mutating into a handful of different strains. Punk, for example, split into categories such as thrash, straightedge, etc. Ambient, however, may become the genre that expands to fill the universe. From the original warblings of Eno and Aphex Twin, ambient DJs now spin everything from ethnic chants to Schoenberg. Ambient has come to resemble *The Face's* facetious description, "anything remotely electronic that lasts longer than 10 minutes and has less than 80 beats per minute." Which, perhaps coincidentally, is also a good definition of Muzak.

4. New Operating Systems

The massive hype surrounding new operating systems is not surprising—after all the OS is the part of the computer that users deal with the most. What is surprising is how slow and plodding progress has been. Every three years, computer processing speeds double. In those same three years, operating systems barely change. Apple is still patching and duct-taping its 1984 operating system, Microsoft is playing catch-up, and Sun has actually managed to go backward. It's not that operating systems are all that hard to build—look at the excellent, public-domain Linux. The problem is that user expectations have been dulled by a decade of equally awful alternatives.

5. Mighty Morphin' Power Rangers

No segment of popular culture changes faster and more dramatically than TV programming for the elementary school set. Each generation demands the complete recapitulation of entertainment history. The current incarnation: the transition from the sweet-and-cloying *Barney* to the all-action, all-violence *Power Rangers*. An unholy melding of *Ultraman* and *Masters of the Universe*, *Power Rangers* represents a return to mid-'80s, over-the-top TV cartoons. But with its aggressively postmodern and relentlessly nonsensical plot lines, watch for rapid crossover to older audiences.

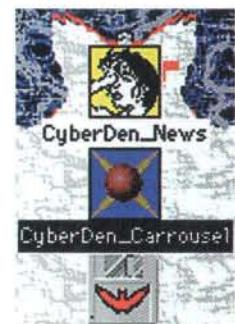
—Steve G. Steinberg (hype-list@wired.com)

The Goth Net

The CyberDen stands out among the growing music-based BBS competition. It is aimed at a particular genre of music fans: the goth and darkwave crowd, who have a passion for gothic imagery, bats, and black clothes.

Started by musician Peter Stone in 1991, The CyberDen features an impressive array of files leaning heavily toward electronic and gothic music. The most fascinating aspect of The CyberDen is the amount of nonmusic material on topics often of interest to underground music fans: anime (Japanese animation), UFOs, and the occult.

A number of independent labels, bands, and 'zines have



Goth geek hangout.

their own "Cyberlink" areas on CyberDen that can also be accessed by anonymous ftp. Record labels like Cleopatra, Astralwerks, 21st Circuitry, and World Domination can be found here, though none seem to be using The CyberDen's FirstClass BBS software to its fullest potential. I would like to see more music samples and multimedia files.

Beyond the music and cyberspace contents, The CyberDen holds its own as a complete online service. There are Internet e-mail and Usenet newsgroups, as well as extensive software libraries for Mac, PC, Atari, and Amiga computers. —Bob Gourley

The CyberDen:
+1 (415) 507 0333,
modem +1 (415) 472 5527.

The Vault of Volts

No intrepid explorer of strange and mysterious electrical devices should pass up an excuse to travel to Minneapolis, home of The Bakken: A Library and Museum of Electricity in Life. Set in a 1920s Tudor-style mansion overlooking Lake Calhoun, The Bakken is filled with a collection of rare books, manuscripts, journals, catalogs, and murals. It easily meets its goal of promoting scholarly research to further the understanding of the history, cultural context, and applications of electricity and magnetism in the life sciences.

The collection of electrical healing devices and promotional posters truly sets The Bakken apart. Imagine standing inside a human-sized ring of coils broadcasting radio waves that raise your temperature a few degrees. Or visualize a complex instrument — like a modern dentist's chair — with multiple probes, pincers, and pushers designed to funnel electricity into your body to treat headaches, toothaches, and muscle pains. Or contemplate a 1780s apparatus designed to resuscitate victims of apparent death — it may have been the world's



The Bakken museum: how the old-timers got wired.

first cardiac defibrillator. Or picture a coin-operated self-treatment device from the turn of the century, trumpeting the words "ELECTRICITY IS LIFE" in big, bold letters.

There are devices with dozens and dozens of dials apparently not connected to anything; devices with electrically wired helmets to map the bumps on your head and phrenologically reveal your personality; devices big enough to sit down in, head exposed, while you're gently toasted in an electric light bath.

From electric fish whose discharges you can listen to in real time, to numerous large and scary-looking electrostatic generators, to bizarre equipment collected together in the basement's medical "quackery" area, The Bakken is guaranteed to energize any budding Dr. Frankenstein or closet Uncle Fester. If you're in the Twin Cities, allow a couple of hours for a pleasant, if not electrifying, visit. — Jordan Gruber

The Bakken: US\$3 adults, \$2 students and seniors; 3537 Zenith Avenue South, Minneapolis, Minnesota; +1 (612) 927 6508. Monday through Friday, 9 a.m. to 5 p.m. (by appointment only); and Saturday, 9:30 a.m. to 4:30 p.m. (tour and demonstration).

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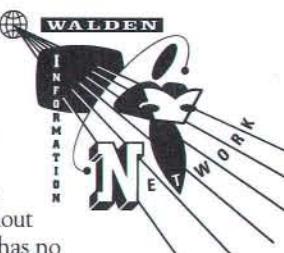
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Virtual Bob Ross

How to Stop Skating

In-line skaters, used to digging a heel into the ground to slow down, have a new way to brake. The Grip In-Line Speed Control system consists of four specially made wheels, two per skate, equipped with aircraft composite calipers that contract around carbon alloy drums when a cable is pulled by hand-held grips. The brakes can be retrofitted to 90 percent of the in-line skate models, and installation is easier than setting up a Christmas tree. You can vary



Face-plant prevention.

braking power by twisting a micro-adjustment on the cable, and even lock the Grip to walk stairs.

Don't want them in your hands? Notch them onto the clips that attach to your belt or pocket. If you keep your knees bent and ease into the brake, you'll slow or stop without diving into the pavement.

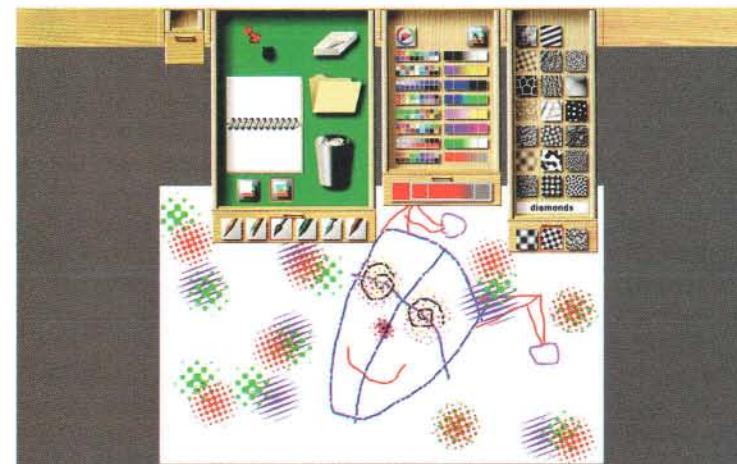
—Roderick M. Simpson

The Grip In-Line Speed Control System: US\$69.95. Canstar Sports USA: (800) 362 3146, +1 (802) 868 2711.

Many people were intrigued by first-generation paint programs such as MacPaint and Paintbrush, which allowed even the novice computer jock to enter the *terra incognita* of digital imaging. But as time went on, paint programs climbed up the complexity and price ladders, and cool computer graphics became inaccessible for all but the pro artist with the big budget and the tarmac-sized digitizing tablet.

Weekend pixel-pushers can once again get in on the fun with Fractal Design's Dabbler program. Like Fractal Design's higher-end Painter program, Dabbler can achieve photorealistic quality with a set of tools designed to look and feel like the real thing. Pencils scratch and smudge, and paint builds up on the "canvas." In fact, the application goes as far as storing its tools in sliding "drawers" and its images in a "sketchpad." Dubious but fun additions to these features are the sounds most of the drawing and painting tools make: pencils scratch and spray paint hisses.

Most importantly, Dabbler's interface is about as simple and intuitive as they come, stripping away most of the complex fine-tuning features you'll find (but rarely need) in Painter. Favorites such as the Seurat and Van



Dabbler: this stripped down version of Painter will keep amateur artists happy.

Gogh presets, the Glass Distortion, and the Auto Cloning effects remain intact, as well as some of Painter's great Paper Textures. If you are new to digital imaging, you'll be amazed but not overwhelmed.

Of course it's still possible to work with existing images in addition to your own creations. Either way, you can use most of the cooler Photoshop Plug-ins, assuming you grow too comfortable with Dabbler's set of options. But the point of this program is that it might be a good idea (and less frustrating) if you first learn to draw "Skippy the Turtle" before you start applying Kai's "Smooth Ooze Lava Lamp" texture or turn everything into fully rendered spheres.

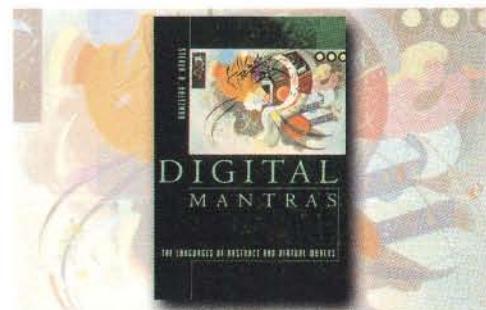
If doing away with all of the technical gobbledegook still isn't enough to start you scribbling with your mouse, Dabbler's documentation comes bundled with step-by-step tutorials by that favorite of amateur artists, Walter Foster Publishing. Leaner, cleaner, and easier to use than Painter, Dabbler is a nifty nexus of art and technology. —Dan Sicko

Dabbler 1.0 for Mac and Windows: US\$99. Fractal Design Corporation: (800) 297 2665, +1 (408) 688 8800.

Digital Mantras

This well-written, erudite romp through several intellectual traditions is reminiscent of Douglas Hofstadter's *Gödel, Escher, Bach*. I have a weakness for grand convergent visions, and Steven Holtzman, author of *Digital Mantras*, took me for quite a ride.

Setting himself the task of theorizing a new digital aesthetics, Holtzman first traces in detail the development of modern linguistics, abstract painting, and Western music, interspersing this rather dense material with liberal references to Indian philosophy and personal stories of travels in Tibet. *Digital Mantras* does for these precursors what Brenda Laurel did for Aristotle and the theatrical tradition in *Computers as Theater*. Holtzman then



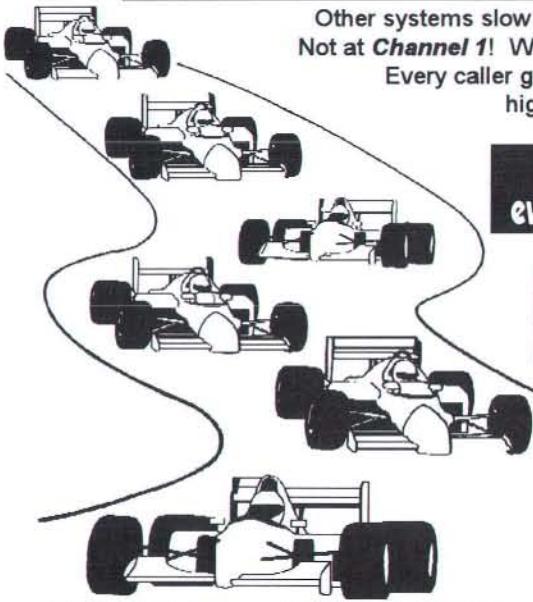
analyzes more recent developments in digitally produced art and music, seeing computers as a means to an "integrated view of art, science, and the mystical."

His speculative answers to the question What means of expression are idiomatic to computers? tend to the abstract, envisioning virtual reality counterparts to serialist music. My own multimedia aesthetics spring from an all-inclusive palette of formerly separate media converging and opening up new artistic possibilities. But Holtzman argues — quite cogently — his narrower, structuralist view, judging the worth of different works by how well they fulfill the inherent structural demands of their particular media. — Jim Gasperini

Digital Mantras, by Steven R. Holtzman, US\$29.95. The MIT Press: (800) 356 0343, +1 (617) 625 8569, e-mail mitpress-orders@mit.edu.

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Jim Metzner's (pulse@igc.apc.org) CD/book – called *Pulse of the Planet* – is due to be published this fall by The Nature Company.

John Morke writes about science and technology but prefers to write love letters.

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Dan Sicko is a programmer/analyst and freelance writer. He still does not have the Sci-Fi Channel.

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John Whalen, co-author of *The 50 Greatest Conspiracies of All Time* (to be published by Citadel Press this fall) is only slightly paranoid.

Joe Wiesenfelder is a freelance writer specializing in audio and video. He has never met a VCR he couldn't program.

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Authoring HTML for Fun and Profit

If you've traveled the gossamer strands of the Web, you've no doubt been impressed by some of the more vibrant sites suspended on the network. You've probably also been put off by some of the uglier ones. If you're like many Web workers, you might even hope to spin your own hub: you've found an access provider who will let you put up Web pages, but you have no idea how to write or create one.

HTML (Hypertext Markup Language) is an easy authoring language – on the surface, it appears as normal as ordinary, household ASCII; however, certain enablers, called "tags," describe and direct the structure of the document. The most important thing to remember when working with HTML is that it describes the structure of a document, not the way it looks. Later, the Web browser interprets that structure when it renders the document. (This explains how a well-written HTML document can be functional on both a US\$20,000 workstation and a \$200 vt100 terminal.)

HTML was developed by research and academic

ic communities and is geared toward more formal layouts and purposes. This accounts for the arcane nature of certain tags, as well as the absence of other important features that might seem missing. HTML simply wasn't designed to overlay text and images, to produce fancy text layout, or to use dozens of fonts. Instead, it specifies things structurally and hierarchically.

There are two parts to an HTML document: its head and its body. The basic, underlying structure of every correct HTML document (its command skeleton) looks something like this:

```
<HTML>
<HEAD>Desired Text Here</HEAD>
<BODY>Desired Text Here</BODY>
</HTML>
```

Usually the only element or "subcommand" that's used within the <HEAD> element is <TITLE>, i.e.: <TITLE>Authoring HTML for fun and profit</TITLE>, where <TITLE> begins the element and </TITLE> closes and defines it. The TITLE, as its name suggests, is that element displayed at the top of your Web browser when you have loaded the page but is not a part of the document itself. (The tags are not case-sensitive.)

Inside the BODY tags, the two most commonly used tags are the paragraph tag <P> and header tags <Hn>, where n is a number between one and six: for instance, <H1> specifies the largest, most important header, <H2> the next, and so on. Always place <P> at the beginning of a paragraph – browsers word-wrap HTML documents to their own widths, so only by using <P> can you guarantee that any two paragraphs will remain separate.

The most important part of the function of HTML is, of course, creating hypertext links. For this task, the anchor tag <A> is used in the same way as the above TITLE and BODY tags, with an attribute called HREF (for Hypertext REference). It looks something like this (let's hypothetically create a link to the *Wired* Web site): Wired's WWW site . Here, the text to be highlighted is encapsulated between the opening tag, <A>, and the closing tag, .

You've found an access provider who will let you put up Web pages, but you have no idea how to write or create one.

The information inside the quotes after the HREF is the URL, or Universal Resource Locator (see "Curling up to a Uniform Addressing System," *Wired* 2.06, page 123), for the object you are linking to. This can also be a path to another document on the same site as this file, i.e. HREF="/directory/otherfile.html."

There are about a dozen more commonly used tags in HTML and perhaps two dozen more uncommonly used ones that are helpful to know intimately, but the above is the bare minimum needed to make basic, yet interesting HTML documents. More complete documentation on HTML is available at:

<http://www.cern.ch/hypertext/WWW/MarkUp/MarkUp.html>; <http://info.cern.ch/hypertext/WWW/Provider/Style/Overview.html>; <http://www.ncsa.uiuc.edu/General/Internet/WWW/HTMLPrimer.html>; <http://www.willamette.edu/html-composition/strict-html.html>; and <http://www.utirc.utoronto.ca/HTML/docs/NewHTML/intro.html>; or at <http://info.cern.ch/hypertext/WWW/Addressing/Addressing.html>.

Weave it well. – Brian Behlendorf

Virtually Yours

A deep burrow into this gopher site yields the (phantom) treasures of virtual reality, replete with a 22-item menu of options. The topics range from a reference to the newsgroup, *sci.virtual-worlds* (archives at a University of Texas host named *wowbag-ger*), to a tarred and compressed bibliography on VR. In the middle you'll discover software, a WAIS database, a museum (an ASCII document, vintage December 1992), a magazine, a guide to VR ftp sites (from May 1993), and even a telnet site aptly named Mind Link! (a BBS in British Columbia running at 14,400 bps that requests you login as guest). Don't get your hopes up. At press time, more than half of the topics were down, but the operative ones are worth checking out. Make sure you type the port number (3003); note that it's not the default gopher 70. Delve into *gopher://ftp.cc.utexas.edu:3003/11/pub/output/vr* for a better look.

A Tuneful Underground

William S. Burroughs once likened "talking about music" to "dancing about architecture." Despite archives filled with information on various groups and songs, Internet users have found his words too true. Lyrics and facts are easily found, but the music itself has remained a mystery. Buying the CD (if you could find the more underground acts) was the only way to decide whether the reviews posted to *alt.music.alternative* were worth anything. This has changed in the past year, however, thanks in large part to Jeff Patterson and Robert Lord of the *Internet Underground Music Archive*. The idea behind the archive is simple: provide an online library of music, accessible via *ftp*, *gopher*, and *WWW*, complete with band bios, photographs, and digitized song samples. All songs are uploaded in *MPEG2* format, and – for you musicians out there – the archive is reachable via anonymous *ftp* at *iuma.com*. Using *Mosaic* or *OmniWeb*, point to *http://www.iuma.com*. No words are necessary.

What are Commander Troi and Lieutenant Worf doing in the engine room? What are Kirk and Spock doing in Spock's quarters? My, my, my. No doubt they're getting those polyester uniforms steamy! Welcome to Usenet's *alt.sex.fetish.startrek*. Conversations on the group are a mix of erotic stories and chatter about which character has the best <pick a body part, any body part>. Like most alt.sex groups, it's as much sexist as sex-y, so you may have to check your politics at the door. Thought you were the only one who saw *Star Trek* characters that way? Heh. Definitely not. If you're a *Star Trek* fan, *alt.sex.fetish.startrek* is always worth a good laugh, and sometimes even a deep breath.

Surf's Up!

It was bound to happen. Some programmers in Carlsbad, California, finally took the metaphor literally and built an awesome Web site dedicated to surfing. At *http://sailfish.peregrine.com/surf/surf.html*, you can check out a surfing tutorial or browse photos of a surf trip to Mexico. The most remarkable item is Surf Windows, a series of video transmissions. Software engineer Ron Britvich has trained a video camera on his friend Eric's home break. Every 10 minutes, the camera sends a few seconds of video to his Mosaic page. Want to know what's happening on the beach? Just click the icon. This portends a happy future for surfers: no more busy signals from the surf line or trips to the beach, boards loaded, to find the surf is weak or closed out. Unfortunately for you Mac and Unix users, this little goodie runs only off a Windows platform, so you'll still have to get sand between your toes. On the other hand, what happens when every surfer in California knows exactly when the waves are going off, and where? Stampede! Grab your board.

The Flamer

Sung to the tune of *The Boxer*, by Paul Simon and Art Garfunkel:

I am just a lurker, though my story's seldom told;
I have squandered my commitments for a terminal and access,
Such are Usenetters.
All flames and jest,
Still a man reads what he wants to read
And killfiles all the rest.
When I started reading newsgroups I was no more than a boy
In the company of newbies,

In the quiet of the online helpfiles,
Running scared.

Confused as hell,

Seeking out the stupid keystrokes all you gurus knew so well,
Looking for alt.tv.saved-by-the-bell.

Chorus:

Li li li (FLAME!);

Li li li li li li li,

Li li li (FLAME!);

Li li li li li li li, li li li li liiiiiii.

Asking frequently asked questions, I come looking for a file

But I get no answers,

Just a come-on from the gang on alt.hi.are.you.cute.

I do declare,

There were times when I was so bored that I read the posts up there,

Luh luh luh luh luh lu luh

Mmm mmmmm mm mmm mmmmm mmmmmmmmm.

(Instrumental)

(Chorus)

Now I'm sending this across the world, and costing the Net hundreds

(If not thousands)

Of dollars, do I really want to be doing this?

Doing this...

What the hell.

In the carrel types a flamer and an idiot by his trade,

And he carries the reminders of every piece of hate (e-)mail

That he got, and

Till he cries out, in his anger and his shame,

"I am leaving, ego's bleeding," but we flame him just the same.

Luh luh luh luh luh lu luh

Mmm mmmmm mm mmm mmmmm, mmmmmmmmm.

(Chorus)

(Chorus)

(Repeat chorus until you feel the song should be over.)

(Repeat it again just to make sure.)

Rex Dart, Spatula Spy *spatula@titan.ucs.umass.edu*

Taking Stock

Say What?

You could go to the system prompt for the time, but when the waves are good, who wants to stop surfing just to check the clock? For timeless surfers who hit the virtual curls without a timepiece, enjoy the audio *Yale University SayTime Server*. Since one must consider transmission time for the audio file sent by the server (as the name suggests, it says the time), YMMV. Both Eastern time – <http://www.yale.edu/cgi-bin/saytime.au> – and Greenwich time – <http://www.yale.edu/cgi-bin/gmt-saytime.au> – are available.

Better late than never.

Moto-Router

Southern California commuters are gaining yet another weapon in the fight against traffic on their busy freeways. Maxwell Laboratories Inc. and the California Department of Transportation have set up *Transnet*, a Web site providing real-time traffic data for many metro areas. Not only does Transnet provide the typical road closures and incident reports, it also displays real-time maps with traffic speeds, digitized photos of chronic trouble spots, and traffic plots showing incoming and outgoing traffic. Some services are still in the demo stage, but San Diego and Los Angeles are already up and running, with more cities soon to follow.

Turn your virtual dial to <http://www.scubed.com:8001/caltrans/transnet.html>, and watch yourself go.

Wipeout!

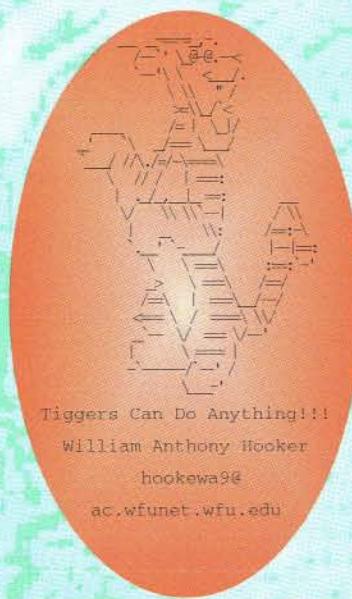
An official announcement was made at this year's DefCon II that *anon.penetifi* has been seriously compromised. We strongly suggest that you not trust this anonymous remailer. (Word has it that some folks are working on a PGP-based service.) We'll keep you posted.

Xed Out

Like that beloved institution, the 24-hour convenience store, *alt.society.generation-x* caters to disaffected youth. No Slurpees here, but there are plenty of reflections on the inherent stupidity of MTV's *Real World*, New Wave nostalgia, and debates on the odds that Madison Avenue concocted the newsgroup as a focus group cum goldfish bowl. Why do so many of the threads here read like GenX beer commercials? Why ask why?

Thanks to Data Transmission Network and Security APL, surfers who want information at their finger tips will be happy to know it's now as simple as a URL command to check their personal portfolios. Forget *The Wall Street Journal* and *The New York Times* – check this friendly Web site for stock quotes and more. You must use the ticker symbol (such as AAPL for Apple), and your info will bounce back in a matter of seconds. Various graphical representations of the Dow Jones industrial average are available for your surfing pleasure. Bear in mind – none of this information is guaranteed or meant to be used in a commercial situation. (The plug will be pulled if the service is abused.) The companies mentioned above use the quote service to advertise their fee-based services. The quote server is forms-based, so Mac surfers must use either MacWeb or NCSA Mosaic 2.0a. Access <http://www.secapl.com/cgi-bin/qs> to find if you made a killing on those frozen pork bellies.

Random ASCII Art o' the Month



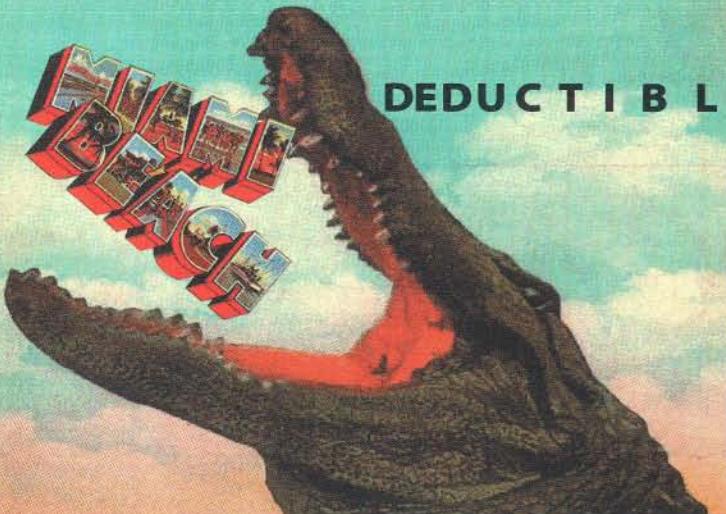
Thanks to the Wired 2.11 Surf Team

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If You're Headed to Miami for IAAPA

Miami is a dangerous place for narcotics, Fidel Castro, and (seemingly) anyone with a German accent. But if you don't fall into any of these high-risk categories, then gear up for some serious amusements. Miami and Miami Beach, a city of 17 islands in Biscayne Bay, make up a hot and sprawling neon metropolis, not just the prime tourist destination of the American South but arguably the commercial center of Latin America and the Caribbean.

The southern end of Miami Beach, known as South Beach, is a long stretch of white sand and tan people. Some call it the American Riviera. Others might call it tacky. But all agree: it is the happening place. The outdoor **News Cafe** is the trendy spot to gawk and be gawked at, but Ocean Drive is littered with places to grab a bite. At **The Strand** you can chew on some leek hay as you graze the menu. Or pick a pizza at **Piola** – it has 58 to choose from.

Since you are lucky enough to be in Miami in season – stone crab season, that is – visit **Joe's Stone Crab**. Joe's has been a Beach landmark for three-quarters of a century; rather than wait that long for a table, make a reservation. And do I really need to tell you what to order?

On the mainland, Coconut Grove once flourished as an artistic and countercultural center, but today its countercultural credentials are dampened by rampant commercialization. Avoid the monstrous **Cocowalk** shopping complex. Instead, explore the Lincoln Road area in northern Miami Beach, an interesting neighborhood of bookstores, boutiques, and the blues (plus Zydeco and funk). The **Stephen Talkhouse** offers live

music four nights a week.

Little Havana, the city's first Cuban district, retains a strong spirit of *el Caribe*. Wander Calle Ocho and the back streets of the *barrio* and travel virtually to Cuba. Don't return without trying *tres leches*, a rich Nicaraguan dessert that drips with sweet milk. You'll find the sticky treat at **El Brazo Fuerte Bakery**, or any other bakery in Little Havana.

Continue the Latin theme at **Yuca**, an elegant and untraditional *restaurante cubano* in the Spanish colonial city of Coral Gables. If Castro tasted the grilled chicken with tamarind-ancho chili glaze, he would move to Miami too!

The natural beauty of the region has lured settlers since Ponce de León landed in 1513. Though concrete and neon now obscure much of this paradise, examples of pristine Florida still exist.

If you don't have time to explore **Everglades National Park**, 30 miles west of Miami, then visit the 83-acre **Fairchild Tropical Garden**. Even the 617 species of palm trees seem terribly temperate next to the blooming pink floss-silk tree and the streaming yellow and orange flowers of the colvillea.

If you're not up on your tropical timetable, here is a seasonal guide to Miami in November: avocados have already peaked, carambola (star fruit) and some citrus fruits are ripe and plentiful, cigars have no season, and (if you're lucky) the hurricanes will be gone. – Jessie Scanlon

Thanks to Maxa Pescovitz and Michael-Anne Rauback, and to the unblushable David Zappitell. Muchas gracias to Maria Ortega.

November 2–5

International Association of Amusement Parks and Attractions; Miami Beach, Florida

The IAAPA annual trade show will be nothing but fun. And fun is a serious business. More than 20,000 amusement professionals will convene to view the latest in fun – from roller coasters to virtual reality – and to discuss industry trends, especially the recent explosion in high-tech entertainment. Registration: US\$25 member, \$75 nonmember. Contact: IAAPA, +1 (703) 836 4800, fax +1 (703) 836 4801.

November 4–6

Doors of Perception; Amsterdam

Home is where you hang your hat. Or is it? The second Doors of Perception conference, sponsored by the Dutch Design Institute and *Mediamatic* magazine, will explore the idea of "home" in the context of our ever-more-computerized and networked world. Sessions will cover everything from Psycho-Ergonomics to Virtual Real Estate. But there are only 1,200 seats, so register early or you won't only be thinking about home, you'll be there. Registration: about US\$400. Contact: +31 (20) 61 70 390, fax +31 (20) 61 74 679, e-mail home@mediematic.hacktic.nl.

November 11–13

Ethics in the Computer Age; Gatlinburg, Tennessee

Has your computer read Kant? Is a mouse moral? Ethics in the Computer Age, sponsored by the Association of Computing Machinery – Special Interest Group: Computers and Society, will reflect on such issues as ethical accountability in cyberspace, individual privacy in an information society, and the cultural impact of the computer. Patrick Sullivan, executive director of the Computer Ethics Institute, will deliver the keynote address. Registration: US\$225 before October 15, \$250 after, students \$50. Contact: Joseph Kizza, +1 (615) 755 4043, fax +1 (615) 755 5229, e-mail jkizza@utcvm.utc.edu.

November 29 – December 2

New York Virtual Reality Expo '94; New York

As VR moves beyond location-based entertainment systems and into design, medicine, and networking, the VR market will boom. Keynote speaker Joel Orr, founder of the Virtual Worlds Society, will discuss the use of virtual worlds in the design process. More than 60 companies will exhibit, and the Venture Capital Forum will include possible investors. Registration: about US\$600. Contact: (800) 632 5537, +1 (203) 226 6967.

November 30 – December 2

The Western Show; Anaheim, California

"Fasten Your Seatbelts," advises the promo for The Western Show, sponsored by the California Cable Television Association. Media mogul Ted Turner is slated for the opening session, and other wired cover boys are invited. Around 15,000 attendees will buckle up for sessions on interactive TV, the infobahn, and the future of the industry. Registration: fee unknown at press time. Contact: +1 (510) 428 2225.

December 13–15

MVA '94: IAPR Workshop on Machine Vision Applications; Kawasaki, Japan

Now you see it, now your computer does. The International Association for Pattern Recognition brings together academics and industrialists for discussions ranging from machine vision algorithms and technical research to industrial applications. Registration: ¥38,000 (US\$380) before November 30, ¥45,000 (US\$450) after. Contact: Mikio Takagi, +81 (3) 3479 0289, fax +81 (3) 3402 6226, e-mail takagi@tkl.iis.u-tokyo.ac.jp.



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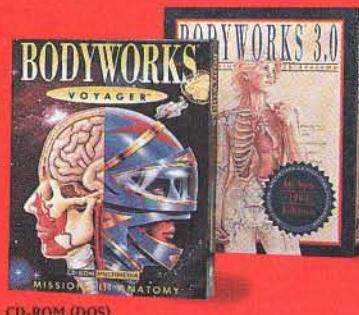
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◀ 123 "modern culture" contains meaningful information. "However incomprehensible it may be, any entertainment with such a large and enduring audience is self-evidently important.... Preposterous violence is fun. Whatever inheres in these crude circuses is something that won't be soaped away with rating systems, revisions, or outright censorship."

Ratings, however, are just fine with Brian Stonehill. And the government has every right to insist on them, he says. "The profit motive, left to itself, is going to harm the national interest. That happens whether you're dealing with the robber barons or with the people in the oil industry who have no concern for the environment. The government's been elected by the people to represent the public good. It's too easy to think of those elected officials as some Big Brother enemy. I think it's certainly acceptable for Congress to hold the game industry's feet to the fire on this."

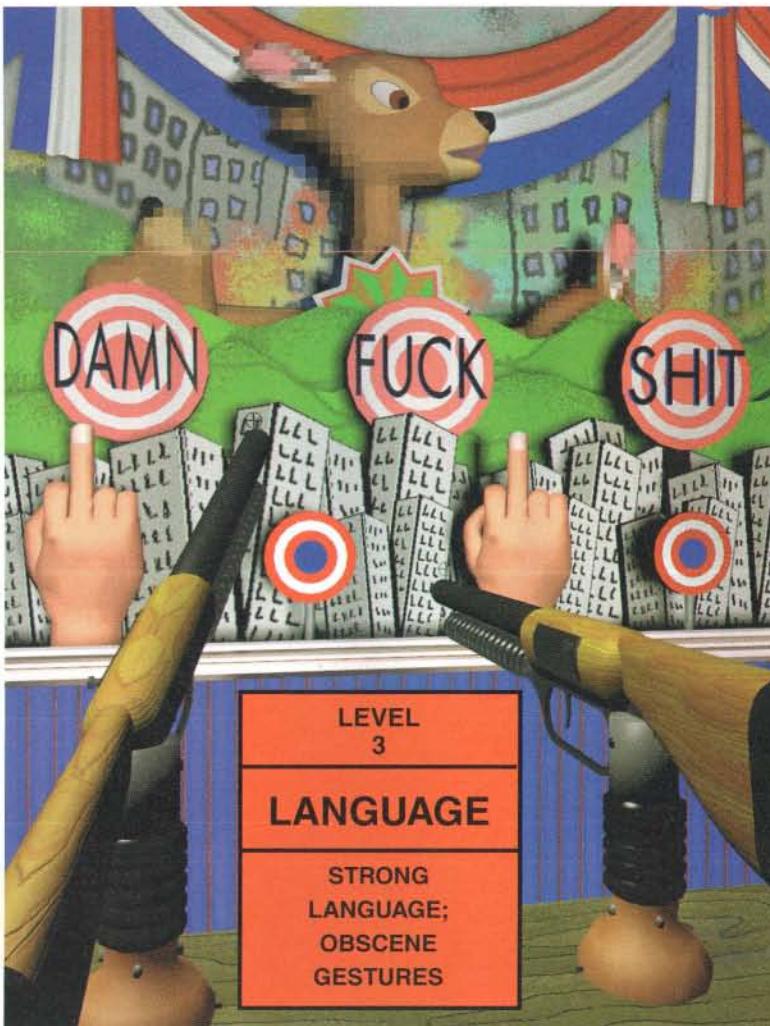
But ACLU lawyer Robert Peck says it's only a matter of time before someone sues and has the ratings declared unlawful. "This present labeling system isn't going to be the end of it. I think some games are going to be negatively affected, saleswise, and the producers of those games will probably bring a lawsuit. We will then see that this system will be invalidated, and we will subsequently move to the next controversial approach on this."

No rating, no sale

The present rating system being voluntary, what's going to happen to games that, for whatever reason, are released *without* a rating? They're going to bomb, as far as Wal-Mart, Toys 'R' Us, and other retailers are concerned. Those stores will not carry unrated games, period. They may also elect not to sell certain games that have received the most restrictive or "severe" rating. "Anything with a strong sexual content, we will not carry," says Chuck Kerby, Wal-Mart's divisional merchandise manager of electronics.

Kerby is not clear on how far Wal-Mart should go in applying "community standards" to the store when it comes to *enforcing* ratings. What's a sales clerk to do when kids who look like they're 13 want to buy a game rated for "mature" consumers? "Asking for proof of age is going to be cumbersome," sighs Kerby. "And we don't want to prevent the sale."

Bob Finlayson, director of marketing and public relations for the Video Software Dealers Association, acknowledges that it's



a sticky issue. "Video stores have computer systems to track all their members, and they can just add the age right in there. With a mass merchant, it becomes a much more difficult situation. Short of requiring proof of age or having a parent accompany the kid to the store, I don't know what the solution is." Senator Kohl insists that the ratings will be less than effective if they are not enforced at the retail level. "There will have to be some effort at the store to see that the ratings are observed," he warned the industry at the July hearing.

Does that mean that the Senate could mandate additional restrictions on games, that it will introduce more Draconian measures to keep kids' minds smut-free? "Frankly, that's a concern," says Sloan Walker. "It depends on whether the current industry response [the rating system] turns out to be accepted, understood, and enforced in the real world."

A novel approach

In the '20s, movie studios began to feel the heat from various religious and social organizations threatening boycotts of films not deemed sufficiently wholesome. The Roman Catholic Legion of Decency eventually got 10 million Americans to sign a pledge that they would not see movies the Church had labeled inappropriate. "It led to a lot of stupidity," says Garth Jowett, a movie scholar who wrote *Film: The Democratic Art*, a social history of moviegoing in the US. "The Legion of Decency would take offense, for instance, at any portrayal of a divorced person looking happy and ban its followers from seeing films that contained such a scene." Nonetheless, politicians, seeing its electoral potential, according to Jowett, introduced a string of bills that sought to heighten cinematic moral standards. To keep customers happy and to keep would-be federal censors at bay, the film industry then started to regulate itself – first in the early '30s, then later with the present rating system, implemented in the late '60s. History, it seems, has a habit of repeating itself.

In addition to movies, the entertainment industry now also sticks compact discs that contain strong language, a practice it grudgingly started in the late '80s partly in response to the efforts of the Parents Music Resource Center, led by Tipper Gore. Rating videogames is the next step in the war over kids' minds.

But why stop there? Byron Dorgan thinks we shouldn't. Senator Dorgan, a Democrat from North Dakota, would like to have the Federal Communications Commission provide a report card for every TV program prior



to broadcast, identifying the levels of violence it contains. But let's go further. Let's rate art exhibitions. Let's rate radio talk shows. *Let's rate books.*

I pose the question in a telephone interview to Joel Federman, director of research at Mediascope, an organization funded by the Carnegie and California Wellness foundations. The LA-based nonprofit is conducting a three-year study on TV violence for the National Cable TV Association. Federman is very much in favor of videogame ratings.

Then you're also for rating books?

That's the first time I've been asked that question. Books usually have jackets that describe what the book is about.

Interactive games and videocassettes of films come in descriptive packaging also.

I'll think about that one.... [After an eternity of 30 seconds] good question. Because when you start to think it through...

If I had kids, I might rather see them play Mortal Kombat than read a Bret Easton Ellis or Clive Barker novel.

Right. [A 17-second silence.]

You want to think about it and call me back?

To be honest, I'm not sure I would have a better answer for you. You may have caught me in a logical... I don't know. I need to think about that one. My gut reaction is that I don't think rating books is a good idea. And where the logic of one ends and the other begins, I'm not quite so sure. I think that books... It's a tough one, because books and videogames can both present ideas. And you don't want to create a regulation of ideas. However, book jackets do present information, and...

If I turn over any game package on an Egghead shelf, it will tell me what kind of game it is. That information is just as reliable or unreliable as the blurb on a book jacket.

Right.

I'm not trying to be difficult, I'm just attempting to think this through. There would be a public outcry if any politician started advocating stickering books. That would be seen as a First Amendment infringement.

Right. You see, the... [a 9-second pause] The whole issue about, the whole issue of the First Amendment is... [another 20 seconds of silence].

I call Federman back a day later to ask him for some information unrelated to the question he was struggling with. He doesn't appear to have found an answer to the book rating issue in the meantime. At least he doesn't bring it up. ■ ■ ■



Violence in, Violence Out?



The premise behind putting warning stickers on games is that screen violence contributes to actual violence. After decades of research, the jury is still out on this point – though studies emphasizing such a link are becoming more numerous. In some experimental settings, children who watch violence on film or TV have been shown to behave more aggressively immediately afterward. But short-term aggression might easily dissipate and have no lasting effect. Other studies show that children who are more aggressive than their peers watch more violent television – but it could be that they were more aggressive to begin with and watch violent programs to partly satisfy their

impulses. What is needed are conclusive data on the long-term effects of exposure to media violence.

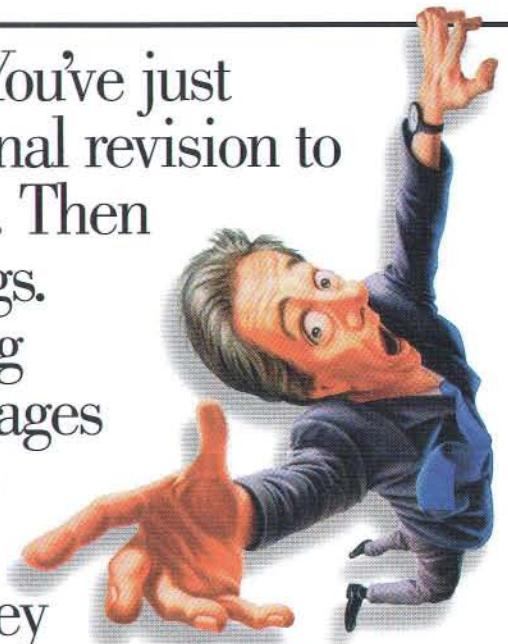
Rowell Huesmann of the Institute for Social Research at the University of Michigan in Ann Arbor, with other researchers, has attempted to tackle the issue by assessing the level of aggression and the intake of violent TV programs in 409 subjects over time. When the children were first interviewed, in 1960, they were all third-graders.

They were reinterviewed in 1970 and 1982. The researchers found that, at least for boys, early TV-violence viewing correlated with self-reported aggression at age 30, especially in cases that involved alcohol. Still, the scientists acknowl-

"It's arguable whether TV and videogame violence has any nasty effects on kids. You can argue the reverse – that it keeps them off the streets."

It's 3:50 pm. You've just finished the final revision to the sales plan. Then the phone rings.

"We're sending over 10 new pages of competitive info." Click. Good thing they lock the windows on this floor. You have to get it into the plan by the end of the day. What now?



◀ 151 edge that drawing causal conclusions is risky. "Childhood aggression is most often a product of a number of interacting factors – genetic, perinatal, physiological, familial, and learning. In fact, it seems most likely that severe antisocial aggressive behavior occurs only when there is a convergence of many of these factors."

Others more bluntly state their reservations. "To make the connection between screen violence and real violence, you've got to be a polemicist with an agenda," says Gilbert Geis, a professor of criminology at the University of California, Irvine. "I don't think there's any scientific evidence worth looking at. It's arguable whether TV and videogame violence has any nasty effects on kids. You can argue the reverse – that it keeps them at home and off the streets." Geis says the problem with the studies – including the one quoted above – is that they involve relatively small groups of children, and that they contain "static" factors that weren't controlled or looked at. "It could be that the children watched those violent shows while, or because, their parents weren't at home," argues Geis. "In which case, their aggressive behavior may be the result of their anger over that."

Firsthand experiences recalled by game players and developers suggest that screen violence can both mitigate and exacerbate tendencies toward real aggression. "If I had a bad day at school, I would head down to the arcade, kill a couple of opponents in *Mortal Kombat*, and feel a lot better," says Cliff Bleszinski, a 19-year-old developer for Epic MegaGames. "Whereas, if someone has a bad day and plays *Mortal Kombat* and loses, he or she might get angrier. I've seen people kicking the machine or whacking the side of it." Bleszinski believes that anything could trigger someone with a violent streak, and that videogames are being unfairly singled out. "If someone's going to explode, who knows what'll light the fuse? It could be not getting pickles on a burger." ■ ■ ■



Beware! This Game Contains Alcohol, Tobacco . . . and Gambling!



So what are these vignettes and symbols that you're suddenly seeing on computer games and videogames? Two ratings boards, representing two competing parts of the industry, are bringing you "buyer beware" notices.

► The Interactive Digital Software Association, an umbrella organization for 12 cartridge/CD-ROM game manufacturers, including Atari, Sega, Nintendo, Philips, Acclaim, and Sony, has appointed child-development expert Arthur Pober as executive director of the brand new Entertainment Software Rating Board. The board, touted as an independent organ, now has a pool of more than 60 demographically diverse part-time raters. These reviewers, after receiving a day's worth of "orientation and training," will work in teams of

three – in round-the-clock shifts, whenever industry demand peaks – to assign the ratings that Pober developed. They'll do this based on videotapes or demo disks that include the most graphic scenes from the game being rated. The process as intended will take about a week to complete and cost the maker of the game US\$500. As this issue of *Wired* goes to press, the association is working on a sliding price scale to allow small companies to submit their games to the board also.

The Entertainment Software Rating Board's ratings fall into five categories: early childhood (ages 3 and up); kids to adults (ages 6 and up); teen (ages 13 and up); mature (over 17); and adults only. Each of these categories can have several descriptors, such as "mild animated violence," "comic mischief," "realistic blood and gore," "use of tobacco and alcohol," and "contains gambling." Sega's previous ratings (GA, MA-13, MA-

17, with GA standing for general audience and MA meaning mature audience) have been discontinued.

► Software Publishers of America, which represents the makers of computer games, has introduced a system that rates violence, nudity and sex, and profanity on a scale of one to four. There are no age recommendations. The group's ratings, which will be implemented by an independent

In both proposals a game can be rated if it contains nudity or violence that was not disclosed during the initial rating process, and the makers may be hit with a fine.

Recreational Software Advisory Council, are assigned by a computer program that calculates the outcome based on an electronic questionnaire that the game maker fills out. Turnaround time is two days. Broad-distribution retail products are rated for a fee of \$500; shareware authors pay as little as \$25.

Both the Entertainment Software Rating Board and the Recreational Software Advisory Council can rerate a product and order the maker to resticker it if the game contains nudity or violence that was not disclosed during the initial rating process. In some cases, the makers could be slapped with a fine.

Congress prefers the Interactive Digital Software Association's system. Senator Joe Lieberman made no secret of it, promising to "do anything I can" to encourage the merging of the two systems. The Software Publishers of America resists adopting the Interactive Digital Software Association's system, however, citing antitrust concerns. Karen Crowther, a spokesperson for shareware and educational-game authors affiliated with the Software Publishers of America, says that senators got "hoodwinked by a bunch of foreign, billion-dollar corporations [such as Sony, Nintendo, and Sega] out to crush their US competition." ■ ■ ■

GBN

◀ 106 scenarios is not that they were drawn up. The amazing thing is that they had such power – were logical, persuasive, easily understood and communicated – that to-the-death enemies, all of whom had it in their power to prevent the flamingos from taking off, began to see a feasible, positive path toward a successful national democratic future together.

The beauty of such scenario thinking – whether in South Africa or elsewhere – is that it basically allows people to tell each other stories about how the world might work. The key element is not whether they are “right” or “wrong.” The key element is a sort of literary criticism, in which people dig down to understand the assumptions and perceptions that underpin the imaginations in each scenario, and evaluate their plausibility, their credibility.

This is not a linear, mechanistic, numbers-driven process. It is more of a dance. The process is sufficiently intuitive that, back on the GBN computer network, I discover that one of the more elegant participants is an artist – Brian Eno, the Grammy Award-winning experimental musician.

Such storytelling also allows people to find the most pleasing scenario. Then they can start figuring how to make it happen, as was the case in South Africa. It is all rather like the way a painter creates a new work. Indeed, the point is not to focus on outcomes so much as to understand the forces that would compel the outcome; less on figures, more on figure-ground.

Quite a stunt.

In fact, during the day I first encountered GBN – as mysterious people filled my head with far-out ideas – the first thing that popped into my mind was Isaac Asimov.

On August 1, 1941, Asimov began a series of stories that came to be known as the “Foundation” series. In it, a conspiracy of high-minded people had figured out a science called “psychohistory” that could reliably anticipate the future.

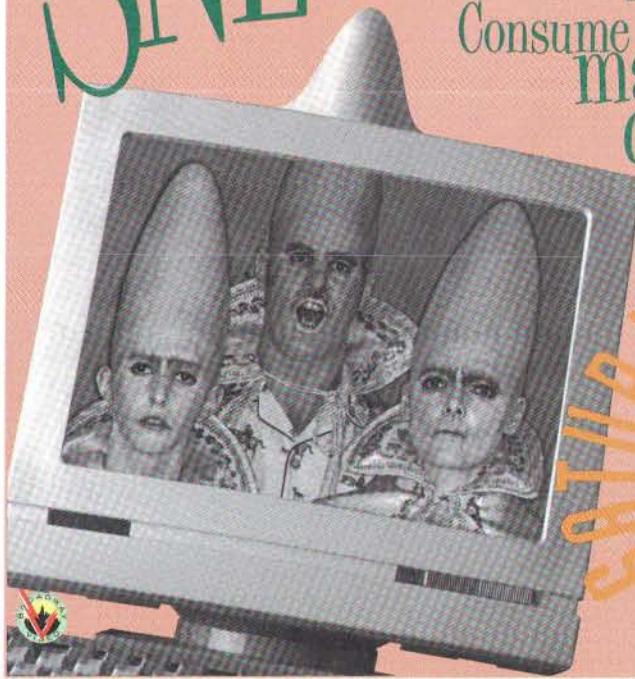
They foresaw a coming galactic Dark Age and launched a plan to cause – to force – a future in which enlightenment would return and triumph over brutal barbarism and savage warfare in only 1,000 years, rather than the 50,000 that it would otherwise require.

At any rate, that first night I could only think one thing about GBN: *Holy shit. This is The Foundation.*

Subsequent events have only marginally disabused me of this framework of understanding. 154 ▶

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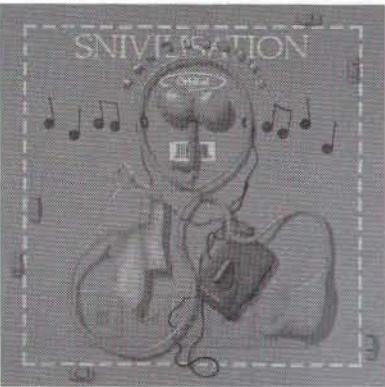
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GBN

One of Wack's iconoclastic beliefs was in putting a premium on listening to heretics – whom he called "remarkable people."

In this view, all the statistical data in the world is of less value than a bracing afternoon with an outcast, renegade, nonlinear thinker.

The members of GBN themselves are such "remarkable people." Co-founder Peter Schwartz, 48, for example, has a welcoming smile, quick wit, halo of hair, and full beard. He resembles the genial host of that kind of restaurant where large men eat large steaks while making large decisions. He is by training an astronautical engineer. He worked for NASA. This allows him to get off lines like, "I am a rocket scientist. I can tell you. Scenario planning is not rocket science."

Schwartz has also studied Tibetan Buddhism and worked closely with Willis Harman, a key figure in the transpersonal psychology movement in San Francisco. Before accepting a post at Shell's Planning Group, he worked at SRI International, the famed Menlo Park, California, research outfit that came up with the widely used psychographic measuring system known as VALS (for "values and life styles"). SRI also developed the computer mouse. Schwartz's is a tame résumé by the standards of GBN.

Member Peter Gabriel, for example, the innovative rock musician, won an MTV Video Music Award for his "Kiss That Frog" video. Rusty Schweickart, who was the lunar module pilot of Apollo 9, is a co-founder of the Association of Space Explorers, an international professional society of astronauts and cosmonauts. Mary Catherine Bateson is the author of *With a Daughter's Eye*, a memoir of her parents, pioneering anthropologists Gregory Bateson and Margaret Mead. Doug Carlston is head of Broderbund, the world's hottest producer of learning software like "Living Books" and *Where in the World is Carmen Sandiego?* Orville Schell is the widely read China scholar. Alex Singer directed episodes of some of television's best series, including *Lou Grant*, *Cagney and Lacey*, *Hill Street Blues*, and *Star Trek: The Next Generation*. There are a ton of members focused on the transformation of the former Soviet bloc.

I gotta tell you. This makes for one hell of a cocktail party.

Okay, so Royal Dutch/Shell was a major influence on GBN; SRI was another (co-founder Ogilvy is also from the latter). If scenario planning is its engine, remarkable people are its fuel.

Its product, however, is nothing less than accelerated evolution. Such rapid evolution is frequently described as "group learning." Its value is stunning. It assumes that morphing into new shapes is the only sustainable advantage any competitive organization has.

This ability to morph is embedded in GBN itself, which, from its offices in an industrial neighborhood of Emeryville, California, can and does – with only 50 employees – present itself in so many bewildering guises that describing it as a tiny consulting company with 55 major corporate clients is as silly as describing Yale's "Skull and Bones" as just a fraternity.

GBN is a "network," which by definition connects to other power structures. There are also different ways in which a person

**At its core GBN is a cause,
a club, and a conspiracy.
If scenario planning is its
engine, then remarkable
people are its fuel.**

can be inside or outside the organization. That makes GBN like the elephant being felt up by the blind men. Its elements can add up in mysterious and perplexing ways.

At its core GBN is a cause, a club, a conspiracy, and a collection of highly energetic particles aimed at bumping up against huge organizations with positive results.

"It's a convention of curious kids," says Eric Best, a GBN staffer. "They want the opportunity and license to explore anything with the smartest people they can find."

"At a time of macro change, it's a collection of magpies and blue jays that set up the screeching when a big animal moves in the forest – because the forest needs that. When we tried to boil it down to two or three words, the phrase 'ruthless curiosity' came up."

GBN can come together in so many ways that describing it organizationally is an almost hopeless task other than to note that there are basically four classes of connection: the five co-founders, the staff, about 90 network members (the eclectic braintrust), and the 55 corporations that are paying customers.

More satisfying than presenting a wiring diagram of GBN is to say how it feels.

Global Business Network, first of all, has

an Anglo-American cast.

The grand old man of the organization is co-founder Napier Collyns, 67. An avuncular British liberal of keen insight and random concentrations, one would almost expect him to be a dedicated breeder of orchids.

Coming from the London office of Shell, Collyns helped impart a scholarly, tolerant, upper-crust seasoning to GBN. He is the kind of person who winces when pressed about the profit-making aspects of Global Business Network. That all seems so, rather, base.

GBN, however, also has a California capacity for American boogie. That is brought to it in part by Stewart Brand, 55, another co-founder. Brand has been an American cultural icon for half his life. This is the man who, in the '60s, won the National Book Award for inventing *The Whole Earth Catalog*. Its motto was so American as to bring a tear to the eye: "We are as gods and might as well get good at it." That might as well also be the motto of GBN.

In the '80s, Brand stuck with his maxim by creating the Well, one of the nation's most influential computer bulletin boards, with which GBN trades staffers, and through which – on a private conference – GBNers stay in touch. (The Well, in turn, feels like a San Francisco bar fight.)

Brand also has become the distinguished chronicler of MIT's Media Lab – where, it has been said, "the future is invented." His interest in the implications of cyberspace continues to be a recurring preoccupation of the members of Global Business Network.

There is another sense, however, in which GBN feels Anglo-American. This allegedly universal set of iconoclasts is relentlessly white and male and middle-aged – even more so than many dinosaur American corporations. Discussions of music tend to focus on the avant-garde, the experimental, jazz, and classical.

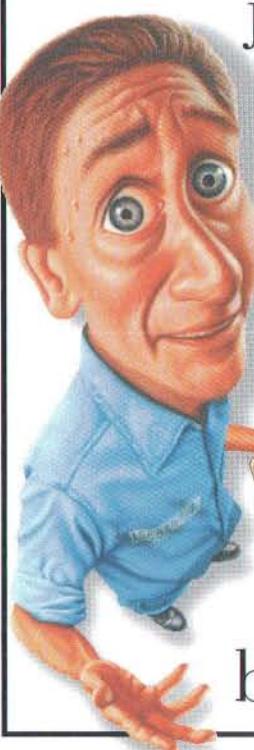
While GBN's European, American, and Asian clients from governments to oil companies to telecommunications conglomerates are geographically, culturally, and racially quite diverse, there are only 15 women in the core network of 90 GBNers, and only one black, one Latino, and one Asian.

Collyns gets quite defensive when this is pointed out. "If anyone knows of a professional scenarist with lots of experience who is a woman, please let us know. Training takes longer," he harrumphs on the computer network. Everyone points to the misogynistic aspects of the oil and gas industry from which scenario planning 156 ▶

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For a moment, you wonder if life in prison without parole would be so bad after all. What now?

◀ 155 sprang as the historical precedent GBN has to overcome. Stewart Brand points to the number of women and minorities at a recent scenario training exercise as the beginnings of a new and virtuous circle.

Barbara Heinzen – who made it through Shell to become one of the world's few woman scenarists, and who is a member of GBN – does not buy all of this. "There is some diversity," she noted, "but not as much as we might see in another three to five years' time, if we continue to develop as a truly global network."

But the women and the minorities who are part of GBN are remarkably inclined to cut the organization some slack. They point to the omnidirectional, informal, friendly, and open-minded atmosphere.

Nancy Hicks Maynard, the former publisher of *The Oakland Tribune* who has been a

pioneer of the science of "complexity," or launching a pirate raid/water fight against the boat of Pamela McCorduck, an explorer of hypertext – a new medium that allows her to represent memory as a dynamic, complex system. All the while, Peter Marshall, the ecologist, is describing the complexities of the wilderness through which you float, and Lee Schipper, the transportation visionary, is doing a Lenny Bruce shtick. Just as fascinating are the paying clients, like Robert Salmon, the Parisian vice chairman of L'Oréal – an outfit deeply interested in GBN's take on the future of women around the world.

GBN feels powerful. A high-ranking corporate officer can get quite upset if you present him with a convincing scenario that suggests an entire multibillion-dollar class of investments on which his company has depended for generations might well become worthless within the next five years.

greatness.

That is to say, it scarcely takes a rocket scientist to generate a disaster scenario.

But to envision success takes talent. And courage.

There is a rather New Age sort of romanticism to all this. (Not surprising: when co-founder Ogilvy, 52, was a young assistant professor of philosophy at Yale University, Garry Trudeau created a Doonesbury character around him named "Dr. Consciousness.")

Yet GBN's headquarters are not in the rarified air of the Berkeley hills. They are in a converted factory in the industrial flatlands of Emeryville, down by the footings of the Bay Bridge. The trendy seven-foot designer grasses someone has thoughtfully planted grow through rusted triple-strand barbed wire.

"Business" is GBN's middle name, and it ultimately lives or dies by its ability to shake down big bucks from hard-headed clients such as Sears, Ford, Hewlett-Packard, Campbell's Soup, and Bell South. Yet the only co-founder of GBN with an MBA is Lawrence Wilkinson; characteristically, he studied classics at Oxford University before that. One wonders how this sort of touchy-feely séance plays back in the halls of power in Washington, London, and Singapore. I mean, really. Sharing knowledge as a way to achieve profit? Isn't this all rather zen?

The answer seems to be that so many top corporate managers around the world are so utterly shell shocked by change that nothing seems implausible anymore. The rise of China, the fall of IBM, the acknowledgement by many that they have absolutely no idea what a career in their industry will look like in 20 years, much less how to educate and prepare their staffs for that future – all they know is that business-as-usual means death.

To the extent that scenario planning offers any logical path at all, GBN starts looking good to business.

Capitalists have deeply internalized, for example, the lesson of laughing at W. Edwards Deming, the American statistician whose "quality management" ideas led the Japanese to glory. They don't laugh so much any more at any idea – no matter how outlandish it may sound on the surface – if there seems to be a kernel of opportunity in it. After listening to a few Genentech scientists at a GBN conclave talk seriously about someone creating a slave class of genetically modified chimps, very little else a corporate officer hears at a GBN meeting seems pre-

People are hungry for new views and outside-the-box thinking.

"Systematic shocks will make or break companies," says one GBN client. "Little curiosities today could be major trends tomorrow."

panelist on *Face the Nation*, *Meet the Press*, and *Washington Week in Review*, agrees. "I've spent a lot of time working on issues of diversity. But I've been very pleased with the reaction to what I have to bring to GBN. Not necessarily being a black woman, but to my work experience, where I've lived – the way my crazy brain is wired."

She compares GBN positively to outfits that may appear more diverse, but, "There's 10 of us, and two of that: there's a very mechanical feel to it that is not at all welcoming to the people being included. They are not there for who they are in a deep sense – who's a good linear thinker, who's an iconoclast, who's a good convergence thinker, bringing the pieces together. GBN just feels comfortable."

GBN feels articulate, artistic, even literary, as well as visionary. It's quite charming to be rafting down the Rio Chama in northern New Mexico on a GBN expedition in which you're pulling an oar next to Joe Traub, a

(This sort of thing is also rather fun.)

Finally, GBN feels optimistic.

At an April GBN meeting, one of the most closely studied scenarios was one developed outside GBN by Roger Cass, titled "The Belle Epoque." It made a closely reasoned (and heavily caveated) case that the coming decades could see the greatest flowering of the human spirit since the Renaissance, with democracy ascendant, international trade flourishing, prosperity growing, and intellectual achievements proliferating as unlimited thoughts bloom and are cross-pollinated on the Net.

This sort of optimism is important. One of Peter Schwartz's favorite stories, repeated over and over again, is how in 1980, IBM calculated that the world market for personal computers over the following 10 years was 275,000 machines. The actual number, he smirks, was 60 million.

IBM was caught not by its inability to foresee problems, but by its inability to imagine

posterous. Besides, if it's the chief economist of the American Express Bank in London sitting next to you who's just said something weird, one feels less self-conscious about stretching one's thinking.

"I'll go out on a limb and take a stab at articulating the 'capitalist' perspective on this rather unique breed of cat," posted Dan Simpson, director of strategy and planning at The Clorox Company, a GBN client member.

"GBN is a rather unique set of competencies and connections," he wrote, "that offers the businessperson three things:

- Technique;
- Food on the Future (challenges to thinking about the future);
- Food on the Present (challenges to rethinking the present differently).

"Whenever I refer colleagues to GBN, it is always in response to the question, Who would you recommend to help us in developing our very first set of scenarios?

"The network is a curious blend of scientists, musicians, artists, economists, anthropologists, and information technology gym rats who form a mosaic by which us capitalists can view our business environment and even our company."

Another corporate client, J.R.W. "Wick" Sloane of Aetna, adds, "People are hungry for new views. The current argot is outside-the-box thinking. By and large, people believe that systemic shocks will make or break companies, and that little curiosities today could be major trends soon. Environmentalism is one example. Thirty years ago a quirky movement. Superfund today.

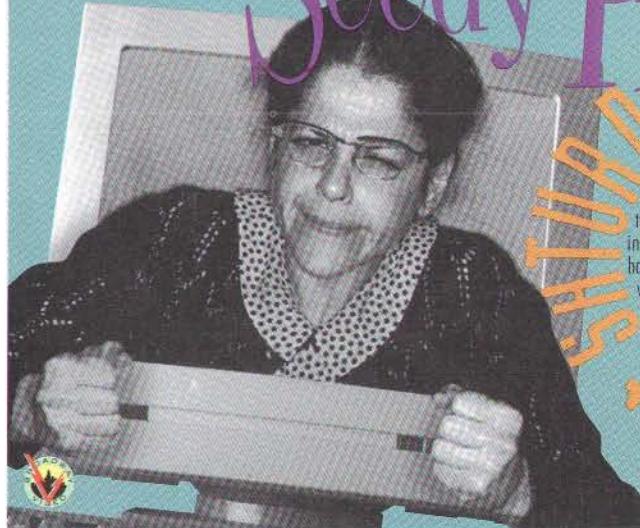
"I take the GBN mailings and send them out to about 100 people from time to time. People are fascinated, interested, and look for more."

In order to close the circle on these futurists, I asked Peter Schwartz to give me three scenarios for the future of GBN, at least one of which would have to be The Official Future.

He complied, but in such a corporate way as almost to lull me into the belief that his was indeed nothing more than a tiny little company housed in a converted factory.

The Official Future involves GBN spinning off television shows for PBS, new publications, that sort of thing. The most interesting offshoot in this scenario addressed that age-old question: if you're so smart, why ain't you rich? "We find that we are in a position to see a lot of companies that are emerging intriguingly in new fields," Schwartz said. "We're thinking about

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“What’s this talk about Saturday Night’s Seedy Prom?”

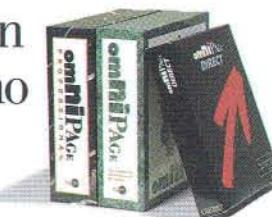
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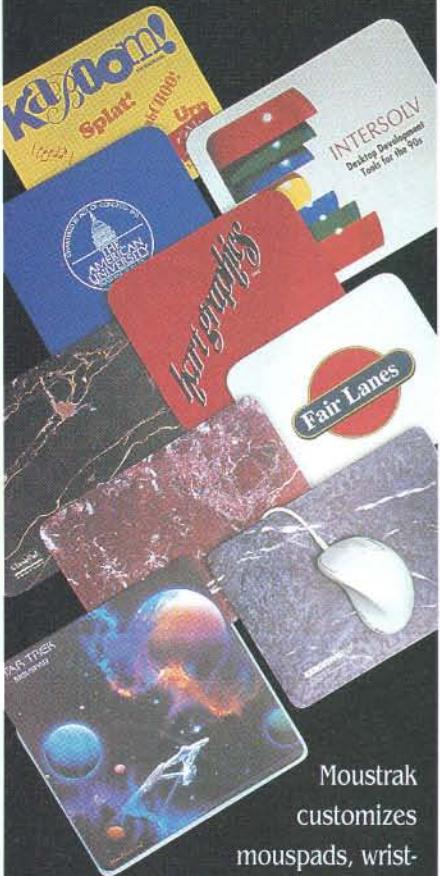


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GBN

◀ 157 starting up a venture fund to invest in them." Entry would be on the order of \$5 million a pop.

But the other scenarios were pretty much what you'd expect of any young company. In "Slow Slide," the phone stops ringing. "Wildest Dreams" involves an extraordinarily high buyout bid from one of consulting's giants.

Not a whole lot in these scenarios about The Men's Club, or The Shape Shifter, or The Foundation, or even Remarkable People. It is enough to shake one's belief that the Global Business Network might be anything extraordinary.

But then, but then....

Back on GBN's private computer network, Sloane, the insurance executive in Connecticut, posted to the group asking for information about how things were going in South Africa.

From Cape Town came back no less an authority on the subject than Adam Kahane, that instigator of the Mont Fleur scenarios that changed the country.

Reading the words Kahane typed to his fellow GBNers, I once again flashed back to Asimov and his depiction of The Foundation. Kahane's eerie posting reminded me of a passage in Asimov in which an agent for The Foundation's founder, Hari Seldon, is speaking to a new recruit:

"You must realize that Dr. Seldon's plans include all eventualities with significant probabilities. This is one of them. It will end well; almost certainly so for the project; and with reasonable probability for you."

"What are the figures?" demanded Gaal.

"For the project, over 99.9 percent."

"And for myself?"

"I am instructed that this probability is 77.2 percent."

"Then I've got better than one chance in five of being sentenced to prison or death."

"The last is under one percent."

For it is possible to get the giggles about the work of GBN at the same instant one realizes it can be deathly serious. Kahane, for example, referred to the scenarios South Africa had in fact gone through on its way to joining the rest of the globe in a marvelously camp secret-agent-sounding burst: "We're in Flamingos now. Icarus is still a danger - but one that is present in everyone's mind, and is therefore less likely to occur. Lame Duck is also less likely for the same reason. Ostrich is past now. The MF [Mont Fleur] team will be reconstituted (with a wider range of viewpoints) this August. I will facilitate again.

Two key members of MF-1 are now in the Cabinet."

Peter Schwartz, the spark plug of GBN, did not giggle online. He of course took it all seriously.

"Since Flamingos was the most balanced and optimistic scenario, it is an interesting outcome," he mused. "It is rare that the best case is the real outcome."

"On reflection," wrote Schwartz, the Hari Seldon of GBN, "it would be interesting to explore why that was so."

Life is not going to be easy in the 21st century for people who insist on black-and-white descriptions of reality. The shape of the truth isn't static; it shifts depending on where one stands. Bottomless truth lies in the gray.

There are multiple layers of truths about this organization. GBN is a network. All net-

The shape of truth isn't static; it shifts depending on where you stand.

Like all networks, GBN shimmers with gray boundaries, vague membership, and multiple – often contradictory – goals.

works shimmer with gray boundaries, vague membership, and multiple – often contradictory – goals. Like the search committee for the MacArthur "genius" grants, Global Business Network assumes that if you are one of the hundred-or-so remarkable people in whom they might have an interest, they know how to find you. It's spooky.

And the network is a tangle. This article on GBN was commissioned by a magazine whose executive editor is a member of GBN. It is running in a magazine which mentions a GBN member in almost every issue. Four GBNers have already been on its cover. And, as I mentioned at the beginning, it was written by a journalist who is a member of GBN.

Hari Seldon would definitely get a kick out of this. ■ ■ ■

For information about GBN, e-mail info@gbnetwork.com or look for GBN's World Wide Web home page at <http://www.well.com/Community/gbn/>.

Rocket Science

◀ 112 tell a story doesn't necessarily depend on it. The most successful games, with *Mortal Kombat* being the exception, work because they're smart, subtle, and well conceived. One of the things we're working on for the future is what we're calling the "Obsidian Tower Chakra" game. It'll be sort of like Dante meets Lewis Carroll in a large black monolith. It has references out of Indian mythology, and the object is to rise up through higher and higher levels of consciousness."



The New Studio System

Rocket Science's Berkeley design facility, located in a spacious four-bay warehouse in the grungy industrial flatlands, hums along like some futuristic movie studio where the soundstages reside in computer terminals. This is where the production teams of writers, artists, animators, sound designers, and live-action coordinators work to create the

Ron Cobb originally wrote *Loadstar* as a screenplay he hoped John Wayne would star in.

audio and video elements that the software engineers will eventually weave into finished games.

A sense of tended chaos pervades in this digital realm of "desktop movie-making." The brick walls are covered with schematic renderings of assorted space gear and matte blowups of jungle backgrounds, reflecting the settings for the company's first two offerings. Meticulously detailed styrofoam space-station models lie about in various stages of construction. At dozens of Mac and Silicon Graphics workstations, designers are at work creating 3-D models that graphic artists will then render and animate. These will be combined with digital matte paintings and live-action photography, resulting in the kind of visual effects usually reserved for major motion pictures. In another bay, sound designers put together various audio effects from a vast library to form soundtracks. Down the way, in an Avid video-editing suite, rough video is digitally edited into finished clips to be integrated into the various games.

"This is a long jump from a couple of guys working nights in a garage and eating cheese sandwiches to produce a game," says Mark

Mullen, Rocket Science's young executive producer. "We don't claim we're making a revolutionary advance in game making, but we're moving in a logical progression, just taking a couple of steps ahead in terms of tools and talent and production methodology. We operate like an independent features production – we define budgets and shooting schedules, do storyboards, establish deadlines, and then execute."

Mullen knows, of course, that the proof is in the presentation and that all the technical advances and production tricks in the world count for naught if what comes through the screen doesn't deliver the punchy thrills the players crave. The Rocket Science tekkies claim that their graphics will be of top motion-picture quality – better, in fact, than a computer screen can presently handle. ("We're waiting for the hardware to catch up," says Mullen.) But the company is also pinning its hopes on the conviction that its target consumer is looking for high-level gameplay that takes place within a fleshed-out dramatic context, with the player assuming the role of a heroic (or in some cases anti-heroic) character moving through an increasingly perilous adventure story toward a big payoff.

"Everybody talks about the 15-year-old out there as the target, but really, the 15-year-old

has become the 22-year-old now, and he wants not only thumb candy, but a story for the mind, a little philosophy maybe, and some resolution," says Mullen. "That's why we've gotten these storytellers like Ron Cobb and Mike Backes and given them the narrative task. Because of the technical restraints, you used to have the people who wrote the code also doing both the art and the story, but now we have these tools that are powerful enough to release the storytellers and artists to do their thing."

But the question persists: will the dedicated gamers embrace these elaborate and expensive story set-ups, or will they impatiently fast-forward past them to get to the joystick action? Will they care that in *Cadillacs and Dinosaurs*, which is based on a graphic novel by Mark Schultz, there is a complicated back story in which human beings are driven underground for 500 years and reemerge into an apocalyptic world where all the fauna that ever existed on earth has reappeared? Isn't the irreducible point of a game simply to, in the vernacular, "drive 'n' shoot" – to blast as many baddies to bits as you can so you can move on to the next level?

"Of course drive 'n' shoot is the point, but we do feel strongly that there is an audience for these stories," Mullen argues. "The hardcore gamers may go straight to the 161▶

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Rocket Science

◀ 159 game after the first time or two, but just the fact that you have characters you care about gives the game more resonance."

"Also," adds David Fox, who designed *Cadillacs and Dinosaurs*, "because of the technology like branching video and our other tools, these games have a style and a rhythm all their own. My last game for LucasArts was *Indiana Jones*, which was a pretty good graphic adventure, but these games are several orders of magnitude above that because of the incredible number of ways a player can move. To me, a perfect game entertains you and makes you think at the same time. What we're saying to the gamer is, If you want to win in this universe, you're going to have to enter it completely, and this is the way you're going to have to think."



The Obi-Wan Kenobi of Production Design

Ask Ron Cobb about the provenance of *Loadstar: The Legend of Tully Bodine*, the "space trucker" epic that is Rocket Science's other launch title, and he'll tell you cheerfully that it's a story of horrible timing ultimately made good. Cobb says he originally wrote *Loadstar* as a screenplay during the CB craze of the '70s, hoping to entice John Wayne to play the lead. But the CB fad died (as did the Duke) before Cobb could get anyone interested, and the script lay neglected for years until Peter Barrett suggested it would work nicely as a trilogy of videogames.

Some of Cobb's Hollywood pals might consider it bizarre to find him working in a Silicon Valley game factory, but for Cobb, who is about the only true graybeard to be found around the place, Rocket Science is just another twist in a long and winding road. An early Vietnam vet, he first rose to prominence as a scathing political cartoonist for the underground *LA Free Press* in the late '60s. Later, he moved to Australia to draw for *The Digger*, a no-holds-barred satirical journal, and instantly became, he says, a figure of violent controversy for his inflammatory jottings. Returning to America, he got involved in films, and over the years he's carved out a formidable reputation as a master of concept design.

Remember the dark, creepy subterranean look of the original *Alien*? Much of that was Cobb's work. How about all the hilarious space beasties getting loaded in the famous cantina scene from *Star Wars*? That was Cobb, too, as were some of the stunning Mars

visuals in *Total Recall*, the underwater imagery in *The Abyss*, and the initial design of the DeLorean time machine in *Back to the Future*. Suffice it to say that Cobb's the guy James Cameron called when he needed a shot of genius for the design of the hydrogen bombs in *True Lies*.

So why videogames? Cobb chuckles. He's loose, he's got that fabulist's gleam in his eye, and he's clearly in his element. "Well, jeez, I guess I just wanted to see where this was all headed," he says. "What I like is that we're going to the heart of the matter here, which is to do what you've always wanted. It's an opportunity to work with some extremely talented people in a place where everybody speaks in the same shorthand and has the same goal, which is to draw new people to games, people who like a movie-like set-up and situation. It's more than creating these great digital special effects so that the pixels don't show; it's bringing people to a rich, more thoughtful environment and providing surprise and delight. To me, it's the auteur theory of gaming."

In *Loadstar*, the gameplay centers around Tully Bodine, a galaxy-weary space trucker who is running his last haul — a shipload of contraband, genetically altered camels — from a port on the back side of the moon to Mars. In a 12-minute movie preamble, Tully, played

by actor Barry Primus, has a scuffle in a bar with his longtime nemesis, the moon's sheriff, played by Ned Beatty. Things get nasty when Tully tries to sneak his cargo off the moon in spite of Beatty's injunction to stay put. The game begins with Tully attempting to launch his ship down a long electromagnetic egress ramp while the sheriff's forces and various pirates try to bring him down. In subsequent episodes of the trilogy, Tully will discover that a huge cataclysm has occurred on one of Pluto's moons and become the reluctant hero who must save the solar system from destruction.

"It's drive 'n' shoot, sure," says Cobb, "but my feeling is that drive 'n' shoot is OK if it's got an edge to it — a story or a joke or a point of view. Fast action and production values aren't enough if there isn't something subjective and human to carry them along. The traditional power of film is embedded deeply here, and the feeling is that if this thing is successful it could end up as a full-length movie. In fact, motion-picture production could eventually engulf us. A lot of film people are attracted to Rocket Science."

Mike Backes, Rocket Science's other major Hollywood factor, is no stranger to the Silicon Valley-Hollywood nexus, having served since 1990 as co-chair of the American Film Institute/Apple Computer Center for Film 162 ▶

You're about to
encounter
something that will
have you doing
things you've never
done before.

Rocket Science

► 161 and Videomakers. After finishing his current project, a film adaptation of Michael Crichton's novel *Congo*, Backes has signed to write a computer thriller for Steven Spielberg. Signing talent like Backes is key for Rocket Science because having access to the best stories is key. All the technology in the world won't help a game maker without exciting characters and an intriguing plot.

"In Hollywood now they all want to get into games, Michael Crichton included," says Backes. "It's because everybody sees this as being sort of at the level of *The Great Train Robbery* at the beginning of films. There's a story, probably apocryphal, that the first time an actor pointed a gun at the audience in that movie, everybody jumped out of their seats. Well, I think that's exactly what we're after with these games, having the joy of making people jump out of their seats."



Test Run

So, the \$20 million question is, Do the Rocket Science games make you jump out of your seat? Well, maybe not literally, but game players are probably going to find them plenty hot. Even on the relatively low-res Sega

CD platform, both *Loadstar* and *Cadillacs and Dinosaurs* show a lot of money on the screen, and the games certainly play as fast and furious as promised. Plus, there are lots of tasty graphic surprises waiting for the ambitious player. In *Loadstar*, for example, if one particular wrong turn is made, the gamer causes Tully Bodine to be zapped so badly that his head melts down to a screaming skull — a truly wonderful morphing effect. In the less graphically complex *Cadillacs and Dinosaurs*, which involves a hair-raising ride through a jungle in a 1955 Caddy convertible, the visuals are faithfully rendered in the two-dimensionality of the graphic comic genre. The gameplay here is also inventive, with the player facing not only all kinds of car-damaging road obstacles, but also the constant possibility of being stomped by an angry saurian.

But will they sell? So far opinion in the games biz is divided. Steve Eskenazi, an industry analyst with Alex Brown & Sons Inc., thinks Rocket Science has a very good shot. "They're taking the technology to a different level," says Eskenazi. "This can only please what I call the 'heat-seeking' players who are always looking for enhanced game values."

Less optimistic is Sean McGowan, a toy industry expert with Gerard Klauer Mattison & Co. "All the hype right now is about a siz-

zling technology, because they haven't put out a game yet," McGowan cautions. "To me personally, *Cadillacs and Dinosaurs* is a dead license — it didn't work as a toy or a comic, and I don't see it as a compelling game. *Loadstar* looks pretty good, I guess, but they'll have to have a lot more than these two titles next year. I don't quite get what the hype is all about, but at the end of the day all that matters is how the games play."

Boss Steve Blank agrees that even if 1994 is not a make-or-break year for Rocket Science, the company needs to make its mark quickly. "This is a hits-based business, no less so than books or records or movies, and there's no claim here that we have a lock on good ideas," says Blank. "Our goal this year is to not wet our pants and embarrass ourselves in front of our friends. But by 1995, we will have to have found the formula for making hits. We'll have to have a home run, otherwise we'll crater."

Among his fellow Rocket Scientists, though, there is no lack of confidence that the team's got the winning formula for thumb candy and that the best is yet to come. "Wait till they see *DarkRide*," laughs game designer Brian Moriarty, referring to the head-whipping abstract roller coaster game the company plans to release in 1995. "We're going to put a barf bag in every box for that one." ■ ■ ■

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Prophet of Privacy

(129 nology for his public key work.)

At that point Diffie was thinking mainly about two problems that plagued cryptography. One was encryption, the practice of using codes to protect information over insecure channels. How could one get around the problem of key management, which required passing a secret key from one party to another? The second problem was that of authentication – was it possible to concoct a method whereby a recipient of a message could know without question that it came from a certain person, in the same way a written signature indelibly identifies a document?

Pondering some ideas that came from techniques in military “identification friend or foe” systems, and combining them with an innovative scheme of protecting computer passwords using a mathematical technique called one-way functions, Diffie came up with a method to solve the authentication problem – a true digital signature. Two weeks later, he realized that by cracking that puzzle, he had also uncovered a way to solve the encryption problem – an amazing solution that used not one but two cryptographic keys.

He clearly remembers that day in May 1975. He and Fischer were living in John McCarthy's house, with the understanding that Diffie would act as a househusband, taking care of McCarthy's daughter and watching the house, while McCarthy was on leave. His routine at the time was to fix Mary breakfast before she went to work at her job analyzing geologic findings at British Petroleum. Then he would spend the rest of the day alternating between domestic chores and research. Sometime during that afternoon he altered the course of cryptographic history by “splitting the key.”

“The thing I remember distinctly is that I was sitting in the living room when I thought of it the first time and then I went downstairs to get a Coke and I almost lost it,” he says. “I mean, there was this moment when – I was thinking about something. What was it? And then I got it back and didn't forget it.”

That night, he went over to Hellman's and told his collaborator about the idea. Hellman recalls during the brief conversation that he first thought Diffie's heretical idea “was a little bit crazy.” But as he thought about it later that night, he began to get excited. Maybe it could work. “I started to think of some analogies,” he says. “It still wasn't like ‘This is it,’ because it wasn't at all clear that you could do it. We now had to figure out how to do it.”

Over the next few months they did just that, working together to mathematically

flesh out the conceptual skeleton that Diffie had envisioned. By the time they were ready to publish, both were aware of the significance of what they had. The first line of their paper, which eventually appeared in *IEEE Transactions on Information Theory*, in November 1976, said it all:

“We stand today on the brink of a revolution in cryptography.”

Now that the aforementioned revolution is well under way, no prospective cryptographer will ever experience the isolation in which Whit Diffie worked in the early 1970s. The Diffie-Hellman breakthrough was a contributing factor to the establishment of an independent nonmilitary movement in cryptography. At 50, Diffie is an elder figure in this community. His advice and comments are eagerly sought from all quarters. He has been a key participant in the work of the Digital Privacy and Security Working Group, an aggregation of more than 50 computer, communications, and public interest groups looking at the problems of privacy in the computer age. He is held in high esteem at meetings of the crypto-rebel Cypherpunks.

Diffie has managed all this while largely skirting jobs with either of the two most common employers of cryptographers – the gov-

ernment and academia. In 1978 he took a job as manager of secure systems research for Northern Telecom, the Canadian equivalent of Western Electric, working in its laboratory in Mountain View, California. One of the best pieces of work he did there was designing a secure phone system; it never saw commercial use, but part of its design became the heart of an innovative product called PDSO, or packet data security overlay, used to provide end-to-end security between hosts on packet data networks. In 1991, Diffie moved to Sun Microsystems, where he became a sort of internal consultant, a companywide resource on security issues. And, of course, a crypto researcher.

“You know, I never know exactly what I do,” Diffie says of the latter work. “I mean, every now and then, of course, I produce something, so I can say, ‘I did that,’ but most of the time I can't remember anything except sort of looking off into space.”

“I've been thinking about the problem of evaluating systems,” he says, referring to the challenging problem of probing a cryptosystem to see if it has a “trapdoor” built in by its creators. “Who needs to trust systems? It's customers, and sort of by definition, they don't design the systems. It may be an insoluble problem – how in the hell can you ever

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encounter
something whose
power knows
no limits and is
growing by the day.

trust any system independent of trusting the designers? I'm not convinced you can in principle find the flaws in things that way. Hiding a trapdoor in a cryptosystem is a much more difficult mathematical problem than just designing a cryptosystem, but it's not obvious to me that you can't create a trapdoor that is in principle unfindable."

In the past year, with Sun's blessing, Diffie has focused on the public-policy issues of crypto. "I've been making a living off of politics," he says, half-jokingly. But to those who advocate limiting strong crypto to preserve the wiretapping capabilities of law enforcement and intelligence agencies, Diffie's new job description isn't very funny. He has emerged as an authoritative opponent of these schemes, particularly the Clipper Chip.

"The key escrow proposal is dreadful," he says, "because the big thing we've gotten away from in contemporary cryptographic technology is the vulnerability that grows out of having to maintain secret keys for longer than you actually need them. Prior to Aldrich Ames, two of the most damaging spy scandals of the last 20 years in the US – Boyce and Lee at TRW and the Walker ring in the Navy – resulted from the fact that keys existed for longer than they needed to exist, and somebody got a chance to siphon some of them off."

If you use public key correctly, particularly in interactive channels like telephones, you can avoid having this hazard. The keys exist only in the equipment, only for the duration of the call, and after that they go away. And so key escrow is just rescuing a dreadful vulnerability." (For more on public key encryption, see "Cypher Wars," page 129).

The Clipper Chip is even less attractive, says Diffie, when one considers who's pushing it. "We're moving our society into a telecommunications environment. I think security mechanisms are fundamental social mechanisms, and what is needed is widespread trust in them – but there's no trusting secret mechanisms designed by an organization most of whose budget goes to spying."

One would think that this sort of talk would place Diffie's picture at the top of an NSA enemy list. But relations between the agency and its most eloquent opponent are cordial. Clinton Brooks, an important architect of the NSA's key escrow scheme, has worked with Diffie on the Association of Computing Machinery's panel on crypto policy. "We came to this from quite different perspectives," says Brooks, with some understatement. "During this experience, my esteem and regard for Whit considerably increased. I found him open, considerate, and eager to listen to oth-

ers' points of view."

The respect is mutual. Even Diffie has tempered his opinion of the organization. "I started out being very antagonistic to them, but after a decade of studying their technology and history, I came to like and respect them much more. I believe I recognize and have for a long time been sympathetic to NSA's goals. I think from a purely nationalistic point of view those goals are certainly understandable. That does not mean that there are not other objectives that seem even more important. Personal privacy certainly seems to me as important as ever, maybe more so. I'm firmly convinced that human freedom can't stand in the long run against improving communications technology, that that will utterly destroy the independence of people." As it stands, he says, "right now people lack freedom in a way that they had it a century or two ago."

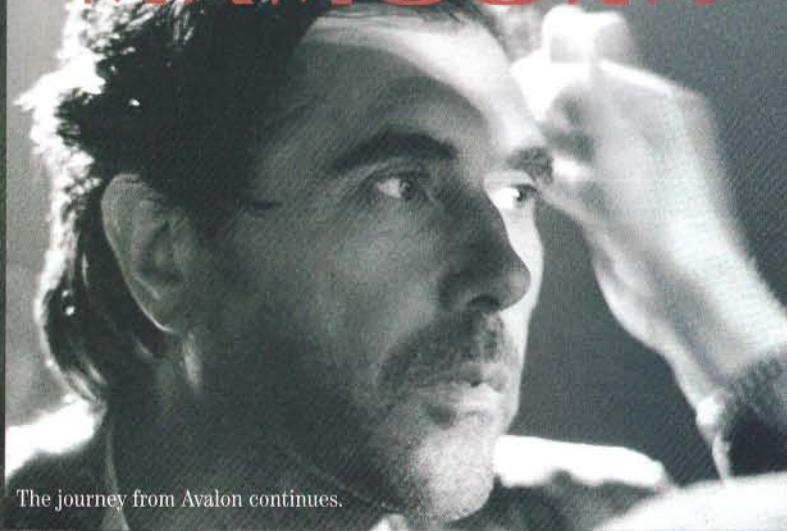
How is this? Diffie explains that in the days of the Founding Fathers, there was no technological surveillance – when two people had a conversation, they communicated with confidence that no one was secretly recording their words. But with every advance in communications technology – telegraph, telephone, fax machine, computer networking, ATM machine, e-mail – more and more

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information that was once transmitted securely became drawn into these relatively insecure channels. And future advances will continue this trend. Thus, Diffie argues, even if the government permits us the use of strong crypto, law enforcement and intelligence agencies will thrive on a continual bonanza of new technologies that will expose our secrets. The least we can have is some crypto to protect ourselves.

"Basically," Diffie says, "one of the things that frightens me about this Clipper sort of thing is that if it's accepted, society can have far more influence over people by governing what technology is available to them than it can by making laws about what they do and punishing them if they don't obey the laws."

Earlier this spring, Diffie had the opportunity to explain some of these ideas to the Senate Judiciary Subcommittee on Technology and the Law, chaired by Senator Patrick Leahy, D-Vermont, who shares Diffie's skepticism about the Clipper Chip. It was interesting testimony. People from both sides of the issue had spoken on the matter, but their arguments were rather *pro forma*. This changed when Diffie, dressed in a bespoke blue suit from Sam of Nathan Road in Kowloon, with his hair flowing down his back, leaned into the microphone and began talking about the deeper implications of the government's policy. It was as if a creature from a smarter species had somehow been introduced into the Kabuki of congressional protocol. He walked the committee through the privacy problem from the 1790s to the present day and beyond and laid out the Clipper controversy in dazzling context. Crypto, he argued, will not upset the balance of power by giving the individual a huge edge over the government – instead we should see it as one of the few resources available to the individual who wants some privacy. "It has been thoughtlessly said ... that cryptography brings the unprecedented promise of absolute privacy," testified Diffie. "In fact, it only goes a short way to make up for the loss of an assurance of privacy that can never be regained."

In the flurry of concepts, however, few appreciated the resonance of Diffie's opening sentences. They summed up Whitfield Diffie's progress since he began his quest more than two decades ago.

"I first began thinking about cryptography in 1972," he testified. "My feeling was that cryptography was vitally important for personal privacy, and my goal was to make it better known. I am pleased to say that if I have succeeded in nothing else, I have achieved that goal."

In spades. ■ ■ ■

Cypher Wars

◀ 129 He went after universities, demanding that they take PGP off their computers and keep it away from their students. But he could not keep the program from spreading: it was already on the Net and impossible to contain.

Early History

Before he released PGP, Zimmermann asked Bidzos for a free license for the patents. Bidzos refused, noting that he had already sold licenses to third parties and didn't want to undercut their business. Zimmermann says that he released PGP because the US Senate's 1991 omnibus crime bill had a measure buried within it that would have directed manufacturers of secure communications equipment to insert "trapdoors" into their products so that messages could be decrypted by the government. Releasing PGP, Zimmermann claims, was a preemptive strike against such an Orwellian future. (Zimmermann has since become the subject of a criminal investigation focusing on PGP's export overseas.)

After PGP's release, Bidzos and Zimmermann came to an agreement – of sorts. Bidzos sent Zimmermann a letter, saying that his company would not sue Zimmermann if Zimmermann stopped distributing PGP in the US. Because

the RSA patent is in force only in the US, Bidzos had no way to stop the international distribution of PGP. Zimmermann signed the letter and sent it back. But soon thereafter, PGP cropped up again – this time on several ftp sites in Europe and Australia. Through the Net, those versions leaked back into the States. Bidzos says that Zimmermann broke the agreement. Zimmermann claims he did not.

However, Zimmermann will admit that he assisted an international team in the development of the second release of PGP. The program was released in the Netherlands.

Back in the United States, cryptography had gone from an esoteric branch of mathematics to front-page news. At the center of the controversy is the Clipper Chip, a key escrow-based encryption system that nearly became the government-approved standard for a wiretap-ready infobahn. "If we wake up one morning with 100 million Clipper phones, it doesn't matter what the laws are," says Zimmermann. Such a vision caused Zimmermann to increase his efforts to make PGP available to anyone who wanted it, particularly in the US. If only the RSA patent weren't in the way!

Détente

Help came to Zimmermann not in the form of a gang of crypto anarchists, but from the

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Massachusetts Institute of Technology, the birthplace of the RSA public key encryption algorithm. Last year, Jeffrey Schiller, MIT's network manager, and James Bruce, both an MIT professor and its vice president for information systems, decided to work with Bidzos to find a way to get PGP out in a form that did not violate Bidzos's patents. "MIT had the strong belief that heavy-duty cryptography, or the ability to encrypt something so that it remains private, needed to be in the hands of the general public," recalls Bruce. "PGP met that need."

In January 1994, Bidzos met with Schiller, MIT Professor Ron Rivest (the "R" in RSA), and John Preston, who oversees MIT's Technology Licensing Office. But they could not come to an agreement. A month later, Phil Zimmermann met with Schiller and Bruce. Again, nothing came of it. Bidzos would not budge. Zimmermann did not have a license the first time he wrote PGP, and he was not going to get a free license now.

Then came the breakthrough. Amazingly, it was unwittingly handed to Zimmermann by the man who had been trying the hardest to stop him. While his sublicensee Public Key Partners had been fighting Zimmermann on the legal front, Bidzos's other company, RSA Data Security, had released a cryptography toolkit of its own, complete with free (but noncommercial) licenses to the same algorithms that PGP had violated. Called RSAREF, the kit was created by RSA Data Security as freeware to help people implement versions of an emerging Internet standard called Privacy Enhanced Mail. (Although PEM provides features similar to PGP, many people had been slow to adopt it because programs that implement the PEM standard are not widely available.) Early versions of RSAREF could only be used for PEM. But in March, Bidzos released RSAREF version 2.0, which contained enough programmatic "hooks" so that it could be used for other purposes as well.

"It became clear that you could build PGP on top of RSAREF," says Bruce, who is convinced that Bidzos never intended his program to be used for those purposes.

Seizing the opportunity, the MIT crew contacted Zimmermann with an elegant proposition: take the encryption engine from RSAREF and drop it in PGP. This way PGP would inherit RSAREF's license for the RSA algorithm in non-commercial applications. At long last, Zimmermann saw his chance to legitimize his guerrilla encryption program. He took the current version of PGP from Europe, version 2.3, ripped out the patent-violating software and plugged in RSAREF's patent-friendly code, dubbing it PGP version 2.5.

In early May, Schiller sent out a message on the Internet announcing that MIT "will shortly distribute PGP version 2.5, incorporating the RSAREF 2.0 cryptographic toolkit under license from RSA Data Security Inc. PGP 2.5 strictly conforms to the conditions of the RSAREF 2.0 license of March 16, 1994." But there was yet another hitch. Bidzos did not want any "unlicensed" copies of PGP in use. In a flurry of telephone calls and e-mail messages, Bidzos asserted that if MIT distributed PGP version 2.5, it would be inducing people with older versions of PGP to infringe upon PKP's patents, since version 2.5 worked with earlier versions of PGP.

Two weeks later, MIT announced that it would no longer distribute version 2.5, but rather a new, "improved" version 2.6. There were a few bug fixes, and at Jim Bidzos's request, this version was modified to work with RSAREF 1.0 rather than version 2.0. But the big change was this: after September 1, 1994, earlier versions of PGP – the ones that infringed upon PKP's patents – would not be able to read messages encrypted by version 2.6 (version 2.6 would still be able to decrypt files encrypted by earlier versions, however). Bidzos says "making trouble for Zimmermann is not the reason" he forced MIT to make the change. "If version 2.6 won't talk to infringing versions, you can't use it to induce infringement."

Zimmermann, predictably, feels otherwise: "I don't think that it was necessary to do it, but we did it anyway as an olive branch to Bidzos," he said.

"Finally we have been able to bring to the public a noncommercial version of PGP that really does not have any sword of Damocles hanging over its head – or over the head of its users," said Schiller. "Anybody in the US can get a copy of this, and RSA is not going to object."

Despite munitions export laws, PGP version 2.6 quickly made its way to Europe via the Net. Zimmermann sees the spread of PGP as a symbol of people's determination to defend their right to privacy. The solution, he claims, isn't fighting whatever key escrow encryption system eventually replaces Clipper as the government standard, but making something better. And, he adds, PGP is it. ■ ■ ■

PGP 2.6 is available from <ftp://net-dist.mit.edu/pub/PGP/>.

RSAREF is available on the Internet by sending e-mail to rsaref@rsa.com.

Simson L. Garfinkel's (simsong@mit.edu) book about PGP will be published in November by O'Reilly & Associates.

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<nicholas@media.mit.edu>
To: Louis Rossetto <lr@wired.com>
Subject:

Digital Etiquette

All Fingers

Imagine the ballroom of an Austrian castle during the 18th century, in full gilded splendor, glittering with the reflected light of hundreds of candles, Venetian mirrors, and jewels. Four hundred handsome people waltz gracefully to a 10-piece orchestra. Now imagine the same setting, but with this change: 390 of the guests learned how to dance the night before, and they are all too conscious of their feet. This is similar to the Internet today: most users are all fingers.

The vast majority of Internet users are newcomers. Most have been on it for less than a year. Their first messages tend to flood a small group of select recipients, not only with page after page, but with a sense of urgency suggesting the recipient has nothing else to do. Worse, it is so simple and cost-free to forward copies of docu-

asking first and without the slightest warning. His story should have been a self-portrait. Common courtesy suggests a short introductory request – as opposed to the wholesale and presumptuous delivery of questions.

In general, however, e-mail can be a terrific medium for both the reporter and the reported. E-mail interviews are far more satisfying for people like me, because replies can be considered at leisure. They are less intrusive and allow for more reflection. I am convinced that e-interviews will happen more and more, ultimately becoming a standard tool for journalism around the world, provided that reporters can learn some manners.

Ugly Habits

Some of the ugliest digital behavior results from having plentiful bandwidth and using it with

careless abandon. I am convinced that the best way to be courteous with alphanumeric e-mail on the Net is to assume the receiver of the message has a mere 1200 baud and only a few moments of attention. An example of the contrary (a habit practiced to my alarm by many of the most seasoned users I know) is returning a full copy of my message with a reply. That is perhaps the laziest way to make e-mail meaningful and it is a killer if the message is long (and the channel thin). It takes so little effort to weave referents into an answer or cut and paste a few relevant pieces.

The opposite extreme is even worse, such as the reply "Sure." Sure, what? Similarly, the use of undefined pronouns is irksome when they refer to an earlier message. As distinguished from spoken conversation, e-mail has variable chunks of time (and space) between segments.

The worst of all digital habits, in my opinion, is the gratuitous "cc" which, among other things, gives new meaning to the word "carbon." It has scared off many senior executives from being online. The big problem with electronic cc's is that they can multiply themselves, because replies are

all too frequently sent to the entire cc list. If a person is organizing an impromptu international meeting and invites 50 people to attend, the last thing I want to see is the travel arrangements of the other 49.

Never Do E-Mail through a Secretary

Some of my closest colleagues claim to be fully available on e-mail. What they mean is that a secretary prints out messages and transcribes dictation. (A senior member of the MIT computer science community gave me the limp excuse: "I can speak faster than I can type." Well, I can, too.)

Using a secretary is hardly the equivalent of being online, and it reduces e-mail to the state of being no more than a fast post office. Sitting at the keyboard yourself and staring at the message (either received or to-be-sent) is a process that engages a different ethos – a certain politeness, some humility, and an ability to be involved in a fashion only one step removed from a real conversation. You are accessible in a new and different way. (Senior management take note.)

It is so easy to send a short and kind reply that I find myself doing so all the time to people who would never get through the forest of secretaries who guard me from telephone calls and manage my meetings. Consider the total time required for me to dictate a short letter (which I do sometimes), to have it typed, to proof it, to sign it, and to have it posted (or, forbid, faxed). The elapsed time is surely no less than 20 minutes of total human time (probably more). By contrast, I can answer the same by e-mail in less than 20 seconds.

My e-mail box is not polluted. (This column may end that.) The reason, I believe, is that people really don't want to foul their own doorstep. At the Media Lab my e-mail responsiveness is a family joke: never more than a few hours, 365 days a year. People are careful not to abuse my accessibility, because it is like an open door. If there is too much noise outside, it is easy to shut it. *Wired* e-mail is usually considered and interesting, and I learn a great deal from it. (But often it is too long.)

If you are a newcomer to this medium, remember that some others are not and may live and die by it. The best netiquette advice I can offer you is *be brief*.

Next Issue: Digital Expression



If you are a newcomer to this medium, remember that some others are not and may live and die by it. The best netiquette advice I can offer you is *be brief*.

ments that a single hit of the Return key can dispatch 15 or 50,000 unwelcome words into your mailbox. That simple act turns e-mail from a personal and conversational medium into dumping; it is particularly distressing when you are connected over a narrow link.

Some of us who have been on the Internet or its predecessors for a long time (a quarter of a century, in my case) pride ourselves on being available. The e-mail address above is my real e-mail address, and I make every effort to answer everything I receive. Therefore, I feel a right to be opinionated about its abuse as a communications medium. Netiquette is particularly important to me because I use e-mail during many hundreds of thousands of miles of travel each year, from foreign lands, in strange places, through weird positions (usually caused by an unfriendly telephone booth or hidden phone jack). One result is that I often see my e-mail at low and heavily error-prone bit rates. This strengthens e-character.

One journalist commissioned to write about these newcomers and their inconsiderate use of the Internet researched his story by sending me and others a four-page questionnaire – without



Meet Rjak.

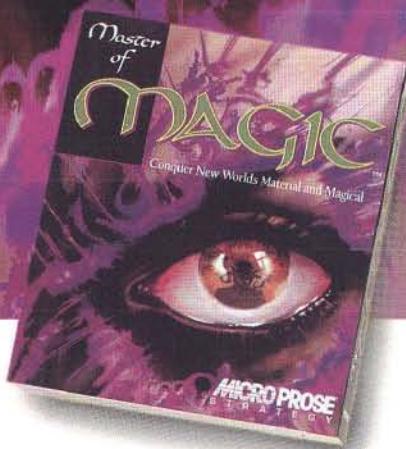
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Spells, heroes and fantastical creatures
are yours to command.

That is, unless Rjak and his friends
destroy you first.

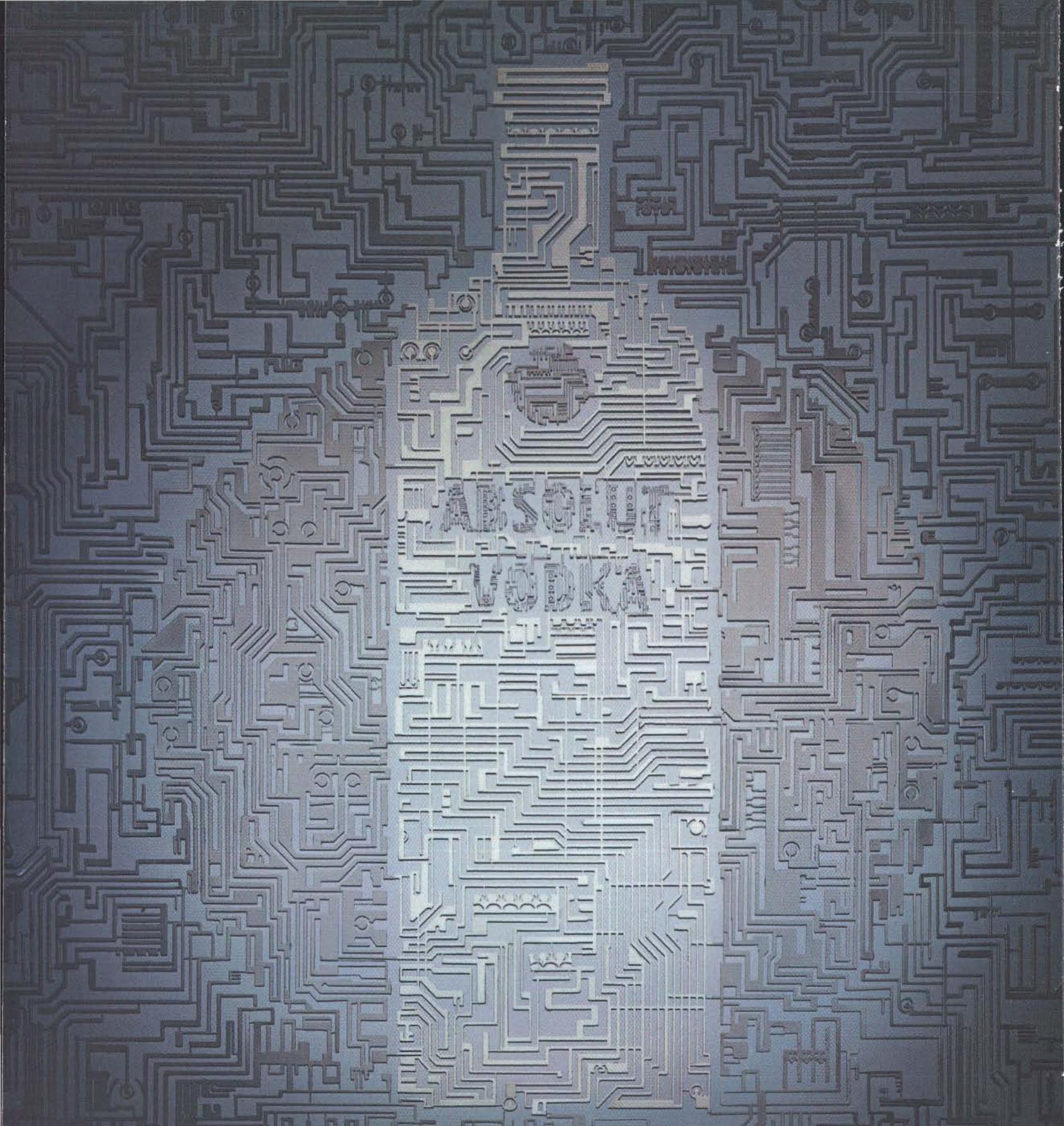
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